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ABSTRACT

This document contains the welcoming and keynote addresses and selected papers from a 1993 symposium of the International Visual Literacy Association. Topics addressed in the papers include: visual literacy; research methodology and design for content analysis of visual images; multimedia as courseware; design issues in authoring multimedia materials, multimedia utilization, the impact of new technologies on artistic thought and aesthetics; hypermedia and teaching methods; visual imagery in distance education; projects in audiovisual and image composition; and technological literacy and the school of the future. (BEW)

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VERBO-VISUAL LITERACY: UNDERSTANDING AND APPLYING NEW EDUCATIONAL COMMUNICATION MEDIA TECHNOLOGIES

Selected Readings from the 1993 Symposium of the International Visual Literacy Association Delphi, Greece, June 25-29, 1993

Edited by Nikos Metallinos

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PREFACE

The International Visual Literacy Association (I.V.L.A.) in addition to the annual conferences, held during the fall season in various cities in North America, has established triennial international symposia that take place during the summer in different countries around the world. The purposes of these symposia are as follows: (1) Many educational institutions and visual communication media scholars in many parts of the world do not have the opportunity to take part in the I.V.L.A.'s annual conferences; (2) issues of global significance regarding Visual Literacy can not be thoroughly presented during the annual conferences due to lack of time and the need to accommodate the paper presentations of a great number of the Association's membership; (3) to expand beyond the boundaries of North America, and therefore to become a truly international association known to many parts of the world with representative members from all continents; (4) to *spread the word* about the objectives of this discourse and its great significance in the visual information age we live in.

Since 1987 the I.V.L.A. has held three international symposia on verbo-visual literacy. The first symposium, "Verbo-Visual Literacy: Research and Theory," was held in Stockholm, Sweden in June, 1987 under the auspices of the University of Stockholm.

The second symposium, "Verbo-Visual Literacy: Mapping the Field," was held in London, England in July, 1990 under the auspices of the British Film Board and the University of London.

The third symposium, "Verbo-Visual Literacy: Understanding and Applying New Educational Communication Media Technologies" was held in Delphi, Greece in June, 1993 under the auspices of the European Cultural Center of Delphi. The Symposium attracted scholars, educators, media practitioners, and teachers from various institutions around the world. In addition to the 53 papers presented, a number of other activities took place, such as interest group meetings, a holography workshop, and visits to Greece's archaeological cities and museums in Athens, Delphi, and Olympia.

The importance of the I.V.L.A.'s international symposia, in general, and the particular purposes of the 1993 Symposium were underlined in the addresses of the Chair of the Symposium and the three Keynote Speakers. The major issues are also discussed in the papers contained in this volume that were carefully selected, reviewed, and edited before they were accepted for publication. It is, therefore, a publication on an issue that is as significant to contemporary visual communication media educators as were the responses of the Delphi Oracle to the Ancient World.

Nikos Metallinos
Chair
1993 Symposium of the I.V.L.A.

ACKNOWLEDGEMENTS

The International Committee of the International Visual Literacy Association started the preparations for the 1993 Symposium in 1990. The Symposium was organized by the Chair of the Committee with the assistance and advice of Committee Members Rune Pettersson (Sweden), Robert Muffoletto (U.S.A.), and Carol Lorac (England) to whom this author expresses his sincere thanks.

This book is the result of the systematic instruction and monitoring of the submitted papers and the collaboration of many individuals. Papers submitted were reviewed by three committee members (R. Pettersson, R. Muffoletto, and N. Metallinos) on the following:

1. Relevance to the theme of the Symposium.

2. Originality and significance of the issues discussed.

3. Research methodology, validity, and reliability of the study.

4. Academic standards and form of submission.

The publication was also supervised by my colleagues W. Lambert Gardiner and Hal Thwaites of Concordia University to whom I express my deep appreciation and thanks for their assistance. Foremost, this publication was made possible because of the care, the scholastic attention, and the hard work of my wife Daisy, to whom I owe an enormous debt.

Finally, I would like to thank the authors whose works appear here for responding to my invitation to attend the Symposium and for their cooperation in submitting their papers according to the editorial instructions and publication guidelines.

Nikos Metallinos
Editor

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WELCOMING AND KEYNOTE ADDRESSES

VERBO-VISUAL LITERACY: UNDERSTANDING AND APPLYING NEW EDUCATIONAL COMMUNICATION MEDIA TECHNOLOGIES

by
Nikos Metallinos

On behalf of the Organizing Committee and the Board of Directors of the International Visual Literacy Association and my colleagues of the European Cultural Center of Delphi, I welcome you to the Third Symposium of the International Visual Literacy Association: Verbo-Visual Literacy: "Understanding and Applying New Educational Communication Media Technologies."

The speed at which the visual communication media technologies are developing and the time required to fully understand and effectively apply them are disproportional. Those of us involved in visual communication media education, the field of study dealing with the development of the languages of visual communication media, have come to realize that the constant and rapid developments in visual communication media technologies hinder the organic evolution of visual communication media education. We are not fast enough in developing the appropriate grammar of visual communication media, which depends on vigorous research studies and empirically verified media theories. We are faced with a challenging academic problem and a complex educational dilemma that we have come here to discuss.

The aim of this Symposium is to bring into focus the specific issues raised by the rapid developments of educational communication media technologies and to carefully analyse the process required for integrating and applying them to the fields of visual literacy in general, and education in particular. Our task, here, is both complex and challenging. We have to increase our awareness to face these complexities and we must focus our attention to the educational value of these technologies. Since we cannot, and need not, stop the rapid development, we must increase our efforts in establishing the basic rules under which they operate. How can we adhere to this premise?

In my view, we can rise to this challenge if we succeed in identifying the problems, if we clarify the issues involved, and if we establish strategies that will help us to understand the educational media technologies. This Symposium has three sessions, each of which explores three specific goals as follows:

Session 1. New Visual Communication Media Technologies

Provides an overview of the present status of new communication media technologies as they relate to the development of verbo-visual literacy in education, and includes papers dealing with such particular issues as:

1. Information, design, graphics, text picture analysis, etc.

2. Computer graphics, electronic cinematography, hypermedia, computer imagery, etc.

3. Television/video technologies, switchers, editors, audio consoles, future telecommunications, etc.

Session 2. Research Findings Related to New Visual Communication Media Technologies From a Range of Different Perspectives

Examines the views and discusses research findings of specialists on

audience effects--particularly on students--of such media.

1. Studies on video technology audience effects.

2. Special studies on verbo-visual communication-related factors.

3. Theses papers on new visual communication media technologies and their specific application to education, i.e., distance education, etc.

Session 3. Future Strategies and Infrastructures

Establishes strategies and develops appropriate infrastructures which will enable the optimum future development of the field of visual literacy.

1. Summaries of theses papers.

2. Synopses of workshops, discussions, dialogues, and debates.

3. Evaluation and final planning.

We have gathered here, in Delphi, once known as the center of the world (Ομφαλός της Γης) where similar gatherings were held, and suggestions were once provided by Apollo's spokeswoman, Pythia, to stated problems and serious dilemmas. We are asking one basic question:

Given the existing visual communication media technologies hardware and software, what strategies must we establish and what infrastructures must we develop that will enable us to respond, effectively, to technology innovations?

As Apollo's spokeswoman Pythia was given three possible answers to each question, or three potential solutions to a stated problem, so have we, today, at this Symposium and in response to this question, provided these three sessions, as the three potential exegeses (interpretations) of the dilemma.

We hope to receive suggestions from all of you, gathered in this historical place, if not to resolve this centuries old problem, at least to familiarize ourselves with its new face.

Welcome to Delphi.

The Delphi Oracle being consulted by King Aegeus of Athens (from a vase painting).

THE AGE OF PIXELS: A CALL FOR VISUAL LITERACY

by
Herbert Zettl

I am very much flattered by Dr. Metallinos' kind invitation to share my thoughts and ideas with such an august body of scholars. At the same time, I feel somewhat burdened by the fact that I do so at the classical center of the world and in the shadow of Apollo. While my remarks to open this 1993 Symposium on Verbo-Visual Literacy may be slightly less oraculous than Apollo's, they are, nevertheless, intended as a challenge for all of us to deal with the age of pixels, the problem of visual illiteracy despite a runaway visual technology, the need for more reliable methods and techniques of aesthetic inquiry, the power discrepancy between the visually literate and illiterate, and with the dangers of visual pollution.

But the age of pixels presents us also with an unprecedented opportunity to develop and communicate with a new and powerful visual language, very much in the spirit of the Greek painter Zeuxis who began a whole new era of visual reality by adding attached shadows to his painting of grapes. Today, like Zeuxis some twenty-five hundred years ago, we stand at the threshold of a new visual reality--the age of pixels--and we must accept the challenge and responsibility to guide its course. This Symposium is an important step toward this endeavor.

If we had been asleep for the past ten years and deprived of television and magazines, we would notice little change in content: The news still thrives on the misery and irrationality, rather than the achievements, of humankind; political candidates still promise the heavens and throw mud; and commercials still sell everything from deodorants to presidents. When watching soap operas, we would not even be aware that we had slept, Van Winkle-like, for the past ten years.

However, we would be quite surprised, if not bewildered, by the change in visual presentation. News presentations rival the best of video games. Titles, people, and whole scenes freeze, stretch, shrink, turn, flip, and fly away into infinity, irrespective of the gravity and seriousness of the stories. The camera has become restless, replacing deliberate and probing insight with casual glance. But even the print media have copied the nervous blip culture of video: gaudy colors, lines, and ill-placed photos break the continuity of layout and render story and advertising copy all but indistinguishable. We may ascribe such razzle-dazzle displays to the playful spirit of MTV youth. But I suspect that it is much more the product of competitive hardware and software manufacturers than creativity exploding in a new Zeitgeist.

Many a graphics generator was developed and used not in order to enhance communication, but because the competition had a newer and seemingly better one. There is the erroneous assumption that it is the degree of pixel manipulation, the way pictures dance, rather than the significance of the message, that holds us glued to the set. We tend to buy the latest digital image equipment simply to keep up with the Joneses or to be one step ahead of them. Resourceful inventors delight in building paint boxes that can generate millions of colors, regardless of whether we can perceive that many, or graphics generators that can surrealistically morph things into animals and animals into humans--all in real time.

I am always amazed by the speed and alacrity with which this new technology is applied to visual communication, regardless of appropriateness as to style or content. For

example, some of the weather maps I see on the air look as though they had just been pulled off a first-grade bulletin board; but because they are computer-generated, we tend to accept them at face value. And, apparently, nobody in television news seems to think that there is anything wrong with having even the most grisly war scene freeze, tumble, morph into a Roman mosaic, and then have its tiles explode in order to make room for the next evidence of human folly and anguish. What bothers me here is not that the age of pixels is primarily hardware- and market-driven, or that the new visual media try to forge a new aesthetic, but that we are so quick and eager to drop our aesthetic sensitivity and judgment.

But being hardware-pushed and having creative people explore a new medium in a rather free-wheeling, seemingly aimless way, is not altogether bad. As any other creative endeavor, pixel technology needs this initial time of casual exploration, a time of play, free of social responsibility and cultural baggage. Eventually, it needs the discipline of art. And this is where we come in: as artists, scholars, critics, and educators. In each of these roles, we need to do some serious thinking, talk to one another, make our findings public so that everybody else has an equal chance to become visually literate. We face a dual challenge: (a) to help people attain even a modicum of visual literacy so that they become aware of their visual environment and recognize the more subtle elements and techniques of aesthetic manipulation; and (b) to step up our research efforts in visual communication in order to help guide the age of pixels and, ideally, chart its course.

I do not have to dwell on the importance of visual literacy education. We have all had a stake in it for quite some time. Like air, most people take their visual environment for granted, be it actual or virtual. They become aware of it only when it is pitch dark, or when the television set goes on the blink. I am often puzzled by how much highly literate people are illiterate when it comes to the understanding of visual structures and aesthetic codes. I remember attending a symposium on television violence, in which well-known psychologists argued the causal connections between violent screen behavior and blood on the street. Their aggression index for the screen event was based strictly on how often and how hard the actors punched each other on the nose. When I suggested that they might be missing an important factor in their aggression index, namely aesthetic violence, I got a blank stare. After explaining that I could make even a tranquil scene communicate violence through lens distortion, editing, and a specific sound track, I finally succeeded in getting a brief and polite smile from one of them. I do not blame them; they simply don't know any better. It is up to us to remedy this problem.

As concerns our research efforts, the field is fertile, and wide open. Even by disregarding the new developments in digital visual communication, such as multimedia and virtual reality, we still have plenty to do when studying some of the more subtle aesthetic elements and structures of the traditional screen display.

I have spent considerable time investigating the problems of structuring screen space in news, and the specific structural requirements of multi-screen presentations. Many of you are probably familiar with my efforts to define such phenomena as graphication, first-and second-order space, and personification in television news, and to describe the structural and dramaturgical differences between single-screen and multi-screen presentations.

Just in case you have missed it, let me fill you in very briefly. When the news anchor or host converses with a guest or field reporter who appears on a secondary screen, such as the famous box keyed over the news anchor's shoulder or a large television set, we tend to extend the news anchor's space (first-order space), into our own living room and share it with the news anchor. In effect, we and the

news anchor are now watching together the person who appears in the box or the secondary television set. By sharing our own space, we tend to bestow on the news anchor more real-life qualities than the person trapped in second-order space.

My multi-screen experiments, which stretch over almost two decades, suggest an incredible potential for visual impact and effective learning. If done correctly, the simultaneous presentation of separate events fuse into a new, more intense and complex, configuration very much like notes in a musical chord. This relatively simple extension of screen space has an amazing effect on all screen aesthetics fields. For example, zooms lose their power, lateral movement gains in prominence, and the off-screen space of the outside screens becomes severely curtailed. By its ability to increase complexity while maintaining order and unity--very much in the cubist tradition--the multi-screen setup offers opportunities for developing a new dramaturgy appropriate to the medium as well as our complicated lives.

While such phenomenological research may succeed in identifying subtle aesthetic factors and their relationships, and even our reaction to it, it does so without reliability. Thanks to my esteemed colleagues, we have at our disposal some instruments that can identify and measure some of the more obvious aesthetic variables. But then, the results often defy actual experience and common sense, however numerically significant. We still lack instruments and methods that are sensitive enough to detect and measure with accuracy and reliability the more subtle and complex aesthetic variables and structures. The problem is not unlike trying to measure love.

And now, enter the personal computer and the age of pixels. The developments in multimedia and virtual reality are so rapid that even the people who are developing it can't keep up with it. I have the feeling that the computer has taken over, telling us what to do.

I always thought that I had been working in multimedia all my professional life--by combining text, still and moving images and sound, into effective messages--until the computer told me otherwise and claimed authorship. And when we look at some of the new multimedia creations, they seem rather primitive in concept and execution. The small, low-definition images do not carry the involving power of impressionism, or the fun of stamp collecting; they are merely hard to see.

However, I feel that we are now barking up the wrong tree. Advanced compression technology and more sophisticated algorithms will certainly take care of such obvious problems. What is much more important for us to see is that digital multimedia systems have catapulted us into cyberspace in which the friendly interaction of humans and machines is the norm rather than the exception. We now have an interactive learning system that can be a true alternative to the classroom or the book, provided that it is used correctly. For example, I have tried in vain to illustrate good and bad editing sequences in a book. The problem is that the book cannot show a sequence in motion, even if we shake the book a little. To see sequence motion in one's mind requires editing experience. But then, these people don't need my book. As we all know, teaching the aesthetics of continuity editing on an actual editing system is very costly and inefficient. A good multimedia program could offer the student to experiment with various shot selections and sequences, and to compare his or her selection with examples of good continuity editing, all under the student's, rather than the instructor's, control. Multimedia systems are ideally suited to teach visual literacy, assuming that the available images are literate in the first place. Because this medium often shows several images at the same time, we can use our discoveries in multi-screen aesthetics to assure an effective multi-image display.

As concerns virtual reality, I am sure that Plato would have preferred it to his

cave in trying to explain the really real, and Kant would have had some more ammunition in explaining the difference between phenomena and noumena.

At first glance, virtual reality seems nothing more than an extension of multimedia displays. All but the most sophisticated systems deliver no more than crude reality images that move in nickelodeon fashion and that imply painting by numbers. Once again, I feel that such criticism, however justified, misses the point. Virtual reality extends not only our visual field, but our control of cyberspace, and immerses us in the mediated reality.

A much more serious problem of virtual reality seems to be an ontological one: the confusion of lens-generated and computer-generated images. So far, the ultimate goal of computer graphics is paradoxically not to simulate the real environment, the way we actually see things, but the way a camera sees them. Many virtual reality displays apply such well-known lens distortions as z-axis compression and stretching, forced linear perspective, variable depth of field, and zooms. Such distortions are understandable, if the computer takes as its raw material the photographic image. But if it is building the image synthetically, such lens-dependency makes no sense. Contrary to the lens, which transmits instantly the portion of the world it sees in analog fashion, the computer must build its world inductively bit by bit, painstakingly adding pixel after pixel through complex algorithms. Compared to the lens, synthetic images seem severely limited by available program modules. Here, we probably need a reorientation of what computer-generated visual images ought to look like. Perhaps they should not try to rival the lens-generated images, but rather create their own style of eye-perceived, or brain-perceived, environments. It is up to us to identify new aesthetic parameters and codes of virtual reality that are structurally appropriate and unique to this new medium and its communication functions. This is where HDTV went wrong. Instead of capitalizing on its own unique attributes, such as real-time layering of effects, it tried to mimic the movies. We can prevent virtual reality from falling into a similar ontological trap.

Finally, here is list of what I consider to be important short-range and long-range objectives:

1. That we actively participate in the new developments of visual technology, help people use the new digital technology with imagination, but also with prudence and responsibility, and that our demand for new technology is based on social need rather than profit and greed.

2. That we step up our efforts to help everybody obtain a minimal degree of visual literacy. I feel that a knowledge of how images influence our thinking, feeling, and behavior, has become one of the major social powers, very much like money and information. The visually illiterate will always be vulnerable to irresponsible persuasion and will remain information-poor.

3. That we increase our systematic research in media aesthetics, that we develop more effective methods and techniques of aesthetic inquiry, and that we share information on an extended basis. I would like to see the I.V.L.A. enlarge its clearinghouse to include more frequent electronic communication, and to broaden the scope of the journal to new fields of electronic visual communication. I would like to see the journal publish articles that struggle with significant questions and tentative ideas as well as the ones that claim to have definitive answers.

4. That, while vigorously pushing the new frontiers in the age of pixels, we beware of the ever-increasing visual pollution and that we establish an ecology that helps to keep our visual environment relatively smog-free, prevent visual apathy, and that help us see and feel with heightened awareness and joy.

5. That we always use visual media with prudence and responsibility, and within a basic ethical framework. And, finally,

6. That we always temper our enthusiasm for modern technology with a sense of history and purpose, and analytical thinking with true understanding and compassion.

ANALYZING THE CONTENT OF VISUAL MESSAGES: METHODOLOGICAL CONSIDERATIONS

by
Robert K. Tiemens

The visual image is so rich, so abundantly loaded with information, that it is impossible to describe or codify its content in any complete way. The seemingly simple task of analyzing a 30-second television commercial which may contain hundreds of images (depending on how the unit of analysis is defined), can become a massive undertaking. Those who are engaged in the study of visual communication understand how impossible it is to construct a verbal description of a visual message. Visual images must be seen to be understood and appreciated.

The richness of the visual image can often conceal many of the relevant features contained in a visual message. Even the trained critic or observer sometimes overlooks the subtle use of production techniques because of the overwhelming amount of information that the visual message contains.

This paper is concerned with how the content of visual communication *text* can be systematically coded and analyzed. The paper sets out to achieve three objectives: (a) to identify specific production variables that shape the visual message--variables that give the message its form, (b) to operationally define and suggest a rationale for observing and analyzing those production variables, and (c) to describe the development of an interactive computer program that facilitates the systematic coding and analysis of visual data.

Systematic analysis of *visual* content has received limited attention (Avery & Tiemens, 1992; Barbatsis & Guy, 1991; Barker, 1985; Mayerle & Rarick, 1989; Porter, 1987, Tiemens, 1978, 1979; Tiemens, Sillars, Alexander, & Werling, 1988). Nevertheless, these studies demonstrate how empirical treatment of the data can enrich the analysis and interpretation of visual content.

One might suspect that to reduce a visual image to an array of empirical data, based on a discrete number of categories, would compound the difficult task of capturing the essence of the visual message. In fact, the opposite is true. By reducing the visual data to a set of numbers, we often expose characteristics of the message that are obscured by the massive amount of information contained in the images themselves.

There are two major obstacles in using a content-analysis approach to study visual images. First, the simple task of coding visual data can become extremely time-consuming due to the vast amount of information that visual images contain. The researcher must, therefore, avoid the temptation to code *everything* and be discerning in establishing the parameters that will guide the analysis. Second, even a reasonable number of coding categories can produce an immense amount of data, and the subsequent analysis of the data can be unwieldy.

VIZ: An Interactive Computerized Coding Program

VIZ is an interactive computer program designed to facilitate the coding of visual data. The program is still in the development stage, but several prototypes have been completed and tested.

VIZ presents a series of screens calling for the input of data for each variable. As the data are entered the program automatically advances to the next screen. That is, when a code "1" that

represents a category is entered at the keyboard, the program automatically advances to the next screen. Thus, only one key stroke is needed to enter the datum which expedites greatly the process of coding.

As the data are entered, a description of the shot according to each code, is printed on the top third of the computer screen allowing the coder to confirm its accuracy. When all data have been entered and confirmed as being correct, the information for each shot is written to a sequential data file on the computer disk. This data file is formatted in such a way that it can be used in any standard statistical program.

Figure 1 shows a representative screen from the *VIZ* program. The example illustrates how the selection of *Medium Shot* as a descriptor for camera framing leads to a sub-category (presented through a pop-up window) that prompts the coder to enter the number of persons shown in the shot. The figure also illustrates how a summary of the coded information is recorded on the screen.

Table 1 outlines the basic categories that are included in the coding program. Each of these categories identify specific production variables that represent various formal qualities of a visual message. Each of these categories constitute a different *routine* in the *VIZ* coding program. A more complete discussion of each variable and the rationale for using each variable in the coding program follows.

Production Variables

Shot Length

The *shot* is the unit of analysis that is typically used to study visual content.[1] The relative duration (length) of a shot reveals two things: First, it indicates the degree to which visual details of an event are emphasized. The longer a visual image remains on the screen, the more dominant it becomes; and the cumulative time which an image is shown (combined for multiple shots) becomes a useful index for comparing and contrasting visual content.

Second, shot length determines the cutting rate of visual pacing of a mediate event. Zettl (1990) calls this manipulation of cutting rate tertiary motion and suggests that it can heighten the intensity of an event and influence the viewer's perception of whether the event is fast or slow. Penn (1971) has shown that cutting rate can affect the perceived potency of an activity of shot content, particularly when persons are depicted in the scene.

VIZ calculates the length of individual shots (in seconds) by simply subtracting the beginning time of one shot from the beginning time of the next shot. Thus, coding of shot length is automatically calculated from a minimum amount of information that the coder enters.[2] A useful technique to facilitate the coding of shot length is to insert or superimpose time-code markers on video tapes that are used for analysis. This

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[1]A *shot* is usually defined in traditional film terms as the continuous, uninterrupted filming by the camera. However, this definition does not account for changes in the visual content that occur through movement of the objects within the frame or movement of the camera. Therefore, the VIZ program relies on an operational definition of shot as a change in the visual content of framing of the screen image.

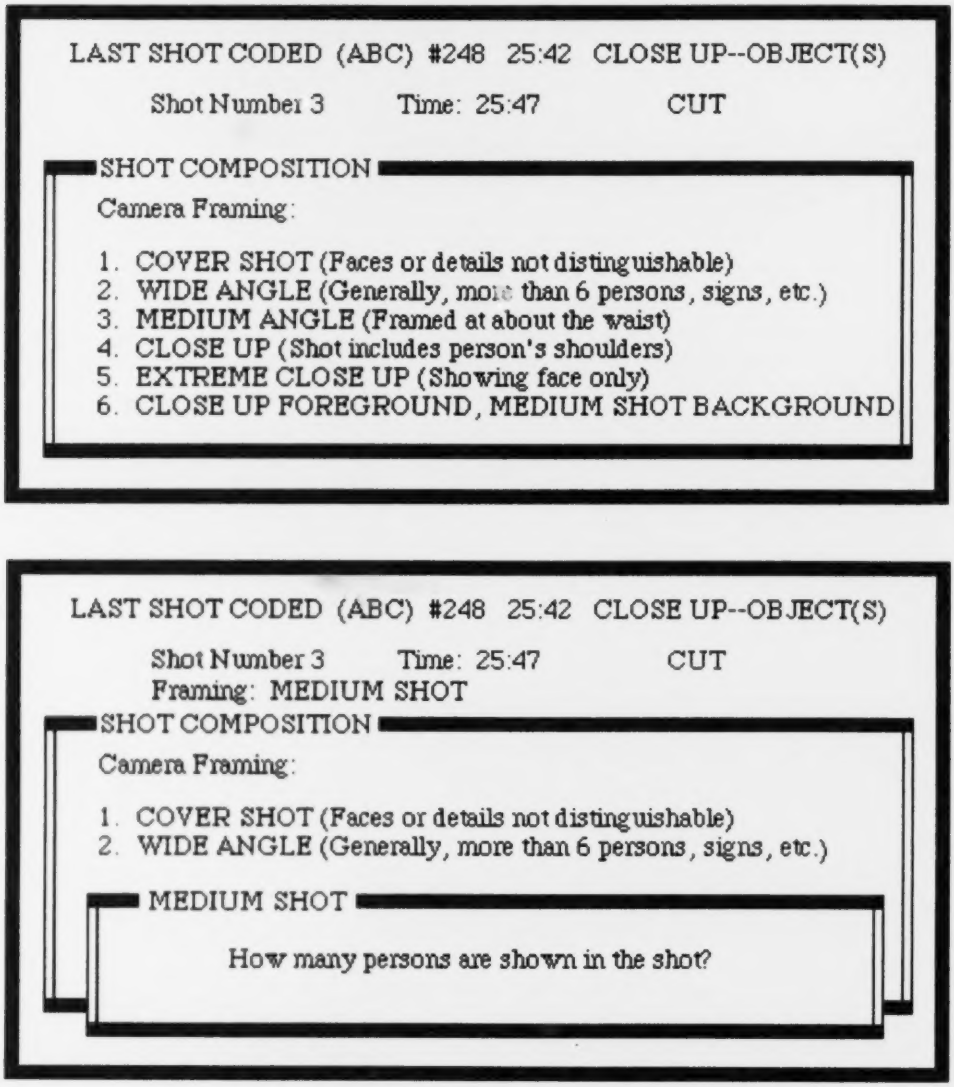
[2]Typically, shot length is recorded in number of seconds, though shorter units of measurement are possible and may be more suitable for coding some kinds of visual content. Some television spots incorporate shots that are less than 1/2 second in length. In analyzing the content of these messages it may be more useful to code shot length by the number of television frames. The present version of VIZ limits coding of shot length to seconds.

procedure allows for very precise coding of shot length (to 1/30th of a second, if desired.

Transition

Transitions define the relationship between shots; that is, how two visual images are related. Visual transitions, like shot length, influence the visual rhythm or pacing of the event. A *cut* produces a quick and abrupt change from one shot to the next. Combined with shots of short duration, cuts heighten the fast pacing or

Figure 1. Representative Screens from the *VIZ* Coding Program


LAST SHOT CODED (ABC) #248 25:42 CLOSE UP--OBJECT(S)
Shot Number 3 Time: 25:47 CUT
SHOT COMPOSITION
Camera Framing:
1. COVER SHOT (Faces or details not distinguishable)
2. WIDE ANGLE (Generally, more than 6 persons, signs, etc.)
3. MEDIUM ANGLE (Framed at about the waist)
4. CLOSE UP (Shot includes person's shoulders)
5. EXTREME CLOSE UP (Showing face only)
6. CLOSE UP FOREGROUND, MEDIUM SHOT BACKGROUND
LAST SHOT CODED (ABC) #248 25:42 CLOSE UP--OBJECT(S)
Shot Number 3 Time: 25:47 CUT
Framing: MEDIUM SHOT
SHOT COMPOSITION
Camera Framing:
1. COVER SHOT (Faces or details not distinguishable)
2. WIDE ANGLE (Generally, more than 6 persons, signs, etc.)
MEDIUM SHOT
How many persons are shown in the shot?

This example illustrates how *VIZ* guides the researcher through the coding program. Coding of the visual image as a medium shot (code 3) prompts the coder to enter the number of persons shown in the shot. If the shot is coded as an extreme close up (code 5), the pop-up window would not appear since the ECU is defined as showing only a person's face. Instead the program automatically enters a "1" for the number of persons shown.

Table 1. Categories for Coding Visual Information

1. Identification of segment (e.g., shot number)
2. Shot transition
   a. Cut
   b. Dissolve
   c. Super Imposition or Long Dissolve
   d. Special effects (e.g., wipes, flips, etc.)
   e. Camera/lens movement, movement of subject or object
3. Length of segment (in seconds)
4. Camera framing
   a. Cover shot
   b. Wide angle shot
   c. Medium shot
      (1) Number of persons shown in the shot
   d. Close up
      (1) Number of persons shown in the shot
   e. Extreme close up (only one person shown)
   f. Close up foreground, Medium shot background
5. Camera treatment
   a. Objective camera treatment
   b. Subjective camera treatment
6. Vertical camera angle of person(s) shown
7. Vector orientation (camera position relative to person(s) shown)
8. Camera/subject motion
   a. Static (no motion)
   b. Subject movement
      (1) Movement along the Z-axis
      (2) Movement only along the X-Y axis
      (3) Direction of movement not relevant to the shot
   c. Camera movement
      (1) Zoom in/out
      (2) Dolly in/out
         (a) Uses Z-axis staging
         (b) Does NOT use Z-axis staging
         (c) Z-axis not relevant to the shot
      (3) Pan/Tilt
      (4) Boom, truck, etc.
   d. Subject + Camera movement
      (1) Uses Z-axis staging
      (2) Does NOT use Z-axis staging
      (3) Z-axis not relevant to the shot
8. Shot content
   a. Primary Category
      (1) Sub-category 1
         (a) Sub-category 2
         (*1*) Sub-category 3
   b. Etc.
   c. Etc.

tertiary motion of an event. *Dissolves*, on the other hand, have a more fluid quality and tend to slow the pace and convey a more relaxed mood. In addition, dissolves create a momentary superimposition which visually blends two images together.

Long dissolves (i.e., 2 seconds or longer) strengthen the connection or visual association between two shots. As one shot slowly blends into the next, the visual images are fused together into a composite image, emphasizing the relationship between the visual content of the two shots. *VIZ* records super impositions and long dissolves as a separate category so that the researcher can examine these instances more closely.

Wipes, flips, rotations, squeeze zooms, and other electronic transitions can impart special connotations of how two images are related. An electronic flip, for example, could show a contrast between visual images suggesting that they represent dichotomies or opposing points of view. Similarly, Zettl (1990) demonstrates how a wipe presents the image of the new shot pushing the old one off the screen. In this manner, the wipe can suggest the replacement of one concept by another, visualized by *pushing away* one image and *replacing* it with another.

Camera movement, lens movement, and *subject movement* often alter the visual content or makeup of the screen image. For example, a closeup image of a person or object may be interpreted differently when the lens zooms out to reveal the context of that image or to show the juxtaposition of another person or object. *VIZ* treats camera movement or lens movement as a traditional device, marking the end of one shot and the beginning of another. Of course, these changes can be ignored by the researcher when analyzing the raw data produced by the coding program.

Entering the choice of camera or subject movement also cause the program to branch to a sub-routine that allows for the coding of more detailed information (see description under the subheading of Motion).

Camera Framing

Camera framing alters the relative size of an image within the defined space of the television frame, thereby influencing the visual emphasis or intensity of the image. *Closeups* create greater intensity and give the image greater importance by directing the viewer's attention to eventful visual detail. *Wide angle* shots, on the other hand, diminish the relative size of persons or objects shown on the screen and thus de-emphasize their visual importance.

Labels used to describe camera framing (e.g., close-up, medium shot, wide-angle shot, etc.) are relative terms and are subject to individual interpretation. Therefore, in coding such data it is useful to have more complete descriptions so that camera framing is consistently defined for each shot. *VIZ* includes the following descriptors to aid coders' judgments:

Cover shot	(faces or details not distinguishable)
Wide angle	(generally more than 6 persons shown on the screen)
Medium shot	(person shown on camera framed at about the waist)
Closeup	(shot of person shows his or her shoulders)
Extreme Closeup	(shows only the person's face or less)

Closeup foreground, Medium shot background

If the shot is coded as a medium shot or closer, *VIZ* prompts the coder to enter the number of persons shown on camera. This becomes useful for identifying two-shots or other groupings that might be relevant to the visual analysis.

Alternatively, visual aids such as the one shown in Figure 2, can be used to illustrate more explicitly variations in camera framing. Aids such as these reduce the ambiguity that is inherent in the traditional nomenclature of camera composition, and help to increase the reliability of coders' judgements.

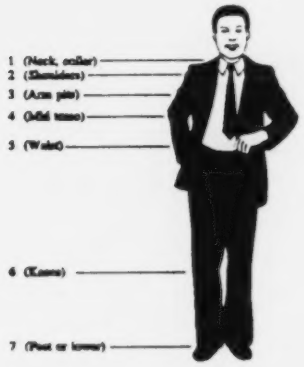


Figure 2. Visual Diagram to Facilitate Coding of Camera Framing

Camera Treatment

Most often the function of the camera is to observe the event, in which case it is used as an *objective* camera. The viewpoint of an objective camera is as an unseen observer and the persons seen on the screen seem unaware of its presence. *Subjective* camera treatment occurs when the person or persons shown on screen look at or talk directly to the camera. In this case, the camera no longer observes the event but rather participates in the event. The camera, and consequently the viewer, becomes more directly involved in the screen event. Objective/subjective camera treatment is an optional coding category in the *VIZ* program.

Vertical Camera Angle

Armer (1986) describes how the vertical camera angle influences our perception of a person shown on the screen:

> When we look down on someone, figuratively as well as literally, we place him or her in an inferior position. He or she becomes subordinate, recessive, smaller than we. . . .We look up to people we respect, who occupy a higher position in society, who tower above us intellectually or professionally. Similarly, when a director places the camera below eye level, looking up at a character, that character assumes a position of dominance, of strength, of importance. (pp. 183-184)

There is considerable empirical support for Armer's explanation (Kepplinger & Donsbach, 1990; Mandell & Shaw, 1973; McCain, Chilberg, & Wakshlag, 1977; Tiemens, 1970); however, as Kepplinger (1991) points out:

> . . .research in this area does not show a consistent effect for specific camera angles. . . .The codes activated by camera angle are no doubt interacting with other codes that are simultaneously processed. *Together* they construct the meaning and effect of a particular shot. (p. 32)

Vertical camera angle becomes particularly relevant when two persons are shown on camera, as in an over-the-shoulder shot. In such instances the vertical positioning of the camera will determine the relative screen placement of the two persons shown in the frame and thus give one person a visual advantage over the other. The person whose image is higher in the frame generally takes on a greater dominance and creates the illusion that he or she is looking down (literally and figuratively) on the other person. This phenomenon was clearly evident in the 1976 and 1988 presidential debates (Tiemens, 1978, 1989).

The *VIZ* coding program offers the following choices for coding vertical camera angle of a shot:

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High camera angle	(Camera looking DOWN at subject)
Medium camera angle	(Camera positioned at EYELEVEL)
Low camera angle	(Camera looking UP at subject)

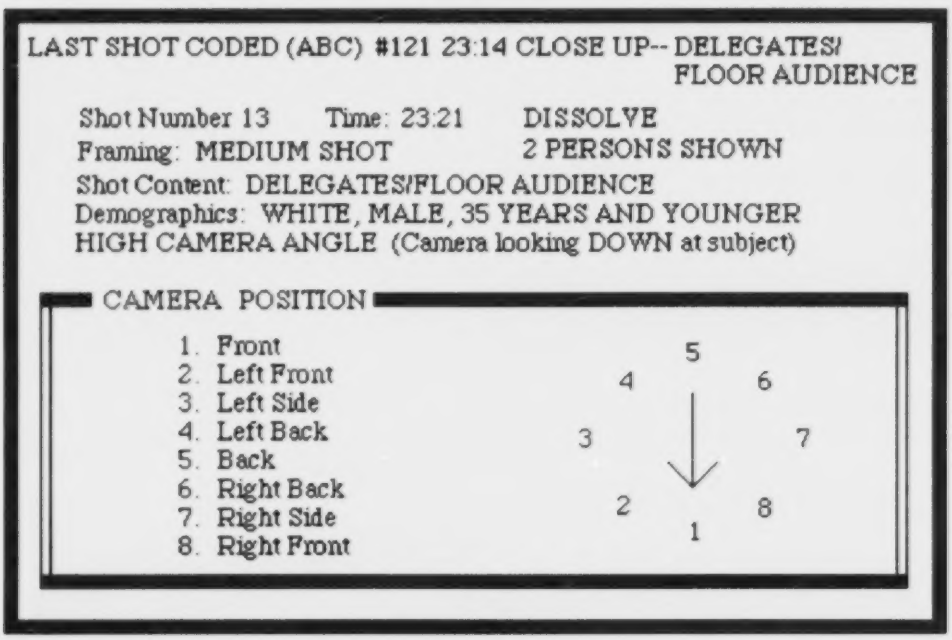
Camera angle not applicable

Vector Orientation

The degree to which televised events are visually unified and coherent is the result of how vector combinations maintain an appropriate pattern of screen direction. For example, a closeup of a person facing screen-left juxtaposed with a shot of another person facing the screen-right show *converging* vectors and suggest that the two are looking at or interacting with one another. If both shots show the two individuals facing the same direction, it suggests that one person is looking away from the other (*continuing vectors*). Zettl (1990) illustrates how, in a public speaking event, the vector combination maintains an expected speaker-audience relationship if shots of the speaker and the audience produce a converging vector combination.

The *VIZ* program treats *vector orientation* as the relationship between camera position and the person(s) shown on camera. The program presents a graphic illustration to facilitate the coding of this data (see Figure 3). By analyzing the vector orientations of juxtaposed shots, the researcher can establish the instances in which a televised presentation uses converging or continuing vectors.

Figure 3



Graphic aids can be presented on the screen to facilitate the coding of data. In this example, the diagram illustrates the camera position (relative to the subject being show) to code vector orientation.

Motion

Motion is a particularly relevant variable because it attracts our attention more than any other visual element. Thus, we usually attend more to what is happening on the screen when the image is moving. Of course, this could be detrimental if the motion detracts from the point of the message; i.e., it can create communication noise.

Zettl (1990) classifies motion according to three distinct types: (1) *primary motion*, the movement of subjects or objects in front of the camera, (2) *secondary motion*, movement induced by the camera or lens, and (3) *tertiary motion*, the movement and rhythm established through editing.[3]

An important element of primary and secondary motion is the axis along which the motion occurs. Zettl (1990) notes that motion along the z-axis (toward or away from the camera or along the axis that the camera is pointing) is particularly advantageous on the small television screen and creates one of the strongest indicators of depth. Thus, any coding scheme that includes motion as a primary variable should classify that motion according to whether it or not it occurs along the z-axis.

Figure 4 shows how the coding program accommodates the classification of different levels of camera and subject movement. If subject movement or camera movement are important variables the program cues the coder for more detailed descriptions of the movement, including whether or not the movement occurs along the z-axis.

Shot Content

Shot content is a crucial variable in visual analyses. The relevance of other variables used in the coding scheme is often found in how they interact with, or are used to define the visual content of a shot. The categories that one can use to classify visual content are endless and must be chosen on the basis of the specific research questions.

The coding program allows for eight general categories of visual content. Beyond these categories, three additional sub levels of categories can be included with a maximum of six categories in each sub level. Thus, if *human subject* represents a general choice for shot content, sub levels may include *gender*, *race*, or *age* of the person shown on camera.

Practical Considerations and Advantages

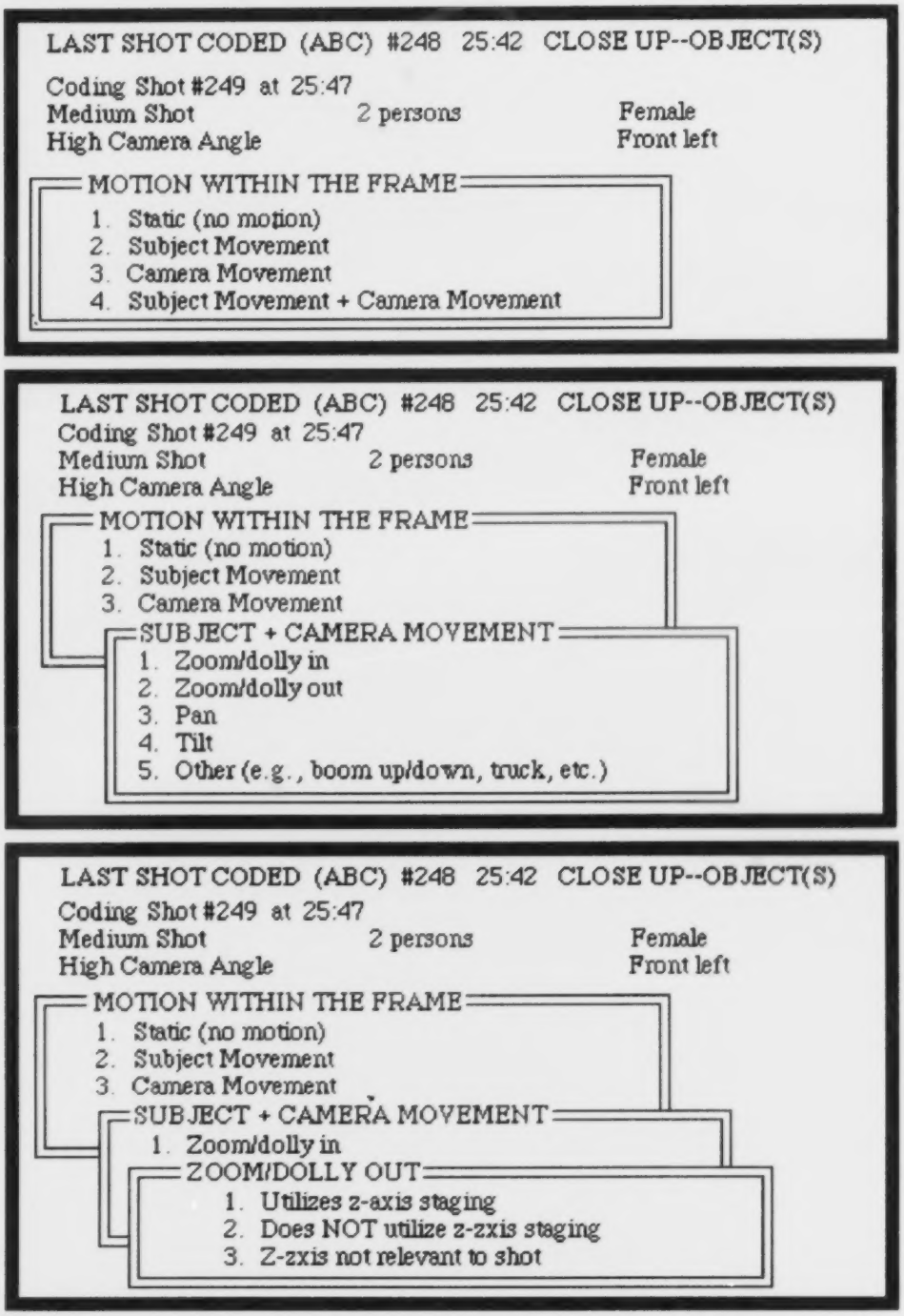
An interactive computer program, such as the one described here, offers a number of advantages for content analyses of visual media. An enumeration of some advantages follows.

A primary advantage of the technique is that the process of coding is much faster. Because each category is represented by a single screen (or pop-up windows within the screen), there is no need for complicated coding sheets. Entering a code for each variable is accomplished by a single key stroke and the laborious task of writing numbers by hand on a coding sheet is eliminated. When a code is entered, the program automatically advances to the next category.

The ease and efficiency of entering data are also facilitated by having the program enter some data automatically. For example, each unit of analysis (in this case a shot number) is identified and entered to the data file automatically. Similarly, the variable of shot length is calculated by the program and entered into the data file automatically; the coder

[3]Tertiary motion is operationalized basically by the length of shots in a video segment. For that reason I have included the concept of tertiary motion under the general heading of shot length.

Figure 4



Sub-categories of coded information are presented by windows. In this example, three levels of information about *motion* are presented. Organizing the categories in this fashion helps the coder to proceed in a logical manner from one step to the next.

only needs to enter the ending time for each shot.[4]

VIZ can be programmed to skip categories which are not relevant and automatically enter a zero data code. For example, if a shot is coded as a *cover shot* the program will skip those categories that call for close-up detail (e.g., number of persons in the shot; gender, race, or age of persons shown in the slot, vertical camera angle, etc.).

The program prohibits codes which are *out of range* from being entered, thus reducing the likelihood of miscoding the visual material. For example, if the maximum data code is *6* and the coder enters a higher number, the program will sound a beep, alerting the coder that a different code must be entered. Similarly, the time marking the ending of each shot must be greater than the ending of the previous shot, thus reducing the chances of entering wrong data.

Internal checks for reliability or consistency of the data are built into the program whenever possible. For example, if a medium shot is coded as showing more than six persons within the frame, the program will remind the coder that the shot should be classified as a wide angle shot and offer the opportunity to recode the shot.

Finally, a major advantage is that the data are written directly to a disk file which can be translated to a spreadsheet program or as a data file for a statistical program such as SAS, SPSS, MINITAB, etc. This avoids the step of writing the data by hand and then rekeying it for computer analysis. None of the data is coded by hand or in written form which further diminishes the likelihood of coding errors.

[4]The beginning of time of each slot is automatically recorded as the time at which the previous shot ended, but the coder does have the option of entering a different beginning time.

Finally, we must recognize that an empirical analysis of visual content is simply one approach toward interpreting the *text* of televised messages and cannot stand by itself. Empirical analysis of visual content must be accompanied by other, more qualitative, methods of interpretation. It has the advantage, however, of rendering a complete and objective *picture* of what the visual images contain. A tremendous strength of the content analysis approach, as suggested by this paper, can render tremendous insights by *revealing* nuances that are otherwise overlooked. As such, it can enhance our understanding and interpretation of visual messages.

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ASSESSMENT OF THE VISUAL IMAGE IN FILM, TELEVISION AND THE NEW VISUAL MEDIA: RESEARCH DESIGN

by
James E. Fletcher

The *visual image*, whether a part of the new visual communication media technologies or of education in general, poses particular challenges for quantitative research.

The new media and education differ in the context provided for the image. In education the image is controlled by an instructor or by the designer of instructional environment. An institution--the college or the school system--binds student and teacher into a common fabric. When speaking of visual media scholars tend to understand and explain images from the perspective of the institutions which prepare and market image-bearing media. This distinction affects the conduct of research into the nature of the image as well.

For purposes of this essay *image* will be defined as a presentation which is not part of the here and now of its audience: It represents a discontinuity in time and space from the immediate visual experience of the viewer (Fletcher, 1979). To describe precisely the effects of some element of a visual image or series of images the researcher must be able to specify (a) the institutional context in which the image is presented, (b) the distance in time and space from the image, to the time and space represented by the context of the viewer, and (c) the relative prominence of the image as a proportion of the total visual field of the viewer; (d) in addition, the researcher must be able to describe the contents of the visual image in unambiguous fashion.

If the environment of the viewer cannot be specified, then the researcher will not know whether the responses to an image in that environment is really a response to the environment rather than to the image. Likewise, if the content of the image cannot be described unambiguously, the researcher will not know which visual element should be credited with the effect measured in the viewer.

Experiments--
Sacred Cows or Bum Steers

The experiment as a tool of scientific inquiry presumes a relatively well defined domain of investigation in which scholars have strong expectations as to the relevance of the measures employed. The logic of the experiment is that a number of variables relevant to the phenomenon under study are held constant or controlled while one or more other variables are systematically manipulated and still others measured for effect. Those variables which are systematically manipulated are called *independent*, while those measured are called *dependent* (Fletcher, 1978).

One of the first steps in assessing the validity of an experiment is to assume that the independent (manipulated) variables have been systematically changed across the experimental images to be presented to study participants so that these changes--and these only--may be taken as the reason that viewers respond differently to the images.

Consider an example from the study of image asymmetry. Asymmetry is specified with relative ease: if right half of image is not the mirror of left half, then an image is asymmetric. Zettl (1973) identifies a series of factors which may make an asymmetric image *right asymmetric* or *left asymmetric*. They include *focus of attention*, *pictorial weight*,

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magnetism of the frame, index vectors. Most of these factors are difficult to apply unambiguously to images. Asymmetry and opposite asymmetry, on the other hand, are relatively easy to specify and affirm. As a consequence, validating two images as asymmetric and *mirror asymmetric* may be a relatively simple matter: a photographic slide projected as it came from the camera and reversed left to right in a slide projector represent an unambiguous manipulation of asymmetry (Metallinos, 1985). A manipulation much more difficult to validate would be that of images which must differ from 30 percent to 60 percent left asymmetric.

Experiments may not be particularly effective in studying visual images until there is a more complete catalog of dimensions along which a visual image can be unambiguously described. At the same time, however, there are good reasons to employ some of the techniques of experimentation in designs for the study of visual images.

Elements of Study Design

One useful way of examining study design is to consider sources of the variance evident in the dependent measures (measures of effect upon an audience member or consumer) employed in the study. Consider a study in which grade school students are asked to report on a five step like/dislike scale their liking of various images presented by slide projector. The resulting judgments of liking provide a range of values for each image. The variance in this measure (X) for any one of the slides presented in the study could be described by this model:

$$\text{var } I = \text{var } X - \text{var } S - \text{var } V - \text{var}$$

where var I - variance due to image manipulation
var X - variance evident in measure X
var S - variance due to unique qualities of the study participant
var V - variance due to study environment
var E - variance due to error in measure X

The part of the variance in the dependent measure which is due to the study manipulation must be isolated in the study. Each participant is responding with her or his own peculiarities, for example. The effects of individual differences may be removed from the liking measure by using a large sample of participants where differences will be less confounding. Or a study design such as the *repeated measures design* may be employed to remove this source of variance statistically. Or the sample may be recruited from persons expected to have the same inherent biases in responding to asymmetric images (such as elderly left handed portrait painters from Poughkeepsie).

The study design may remove the influence of variance due to environment by *holding constant* the environment in which the image is presented. This is commonly done by conducting the studies in laboratory settings. One consideration among others is that the image occupies the same segment of the visual field of each study participant.

Variance due to error in the dependent measure is reduced to a minimum by selecting measures which are highly reliable, as indexed by a reliability coefficient. The newer or more complex the dependent measure, the more important it is that the research report include an estimate of its reliability.

If in a study of visual images it has been possible to control or account for variance due to individual differences in study participants, variance due to the study environment and variance due to measurement error, the design is said to be *sensitive*, permitting the researcher to equate a measured difference in response to difference in images.

Measures and Measurement Techniques

An explosion in interest in quantitative measures appropriate to study of visual images has occurred in the past two decades. Some of the new measures are the consequence of greater interest in visual images as a subject for study. Others are a byproduct of technology developed for other uses. Measures and measurement techniques will be represented in this discussion by (a) magnitude estimation scaling, (b) Cloze procedure, (c) multivariate measures of feelings, (d) tachistoscope, (e) eye-tracking, and (f) electrodermal recording.

Magnitude Estimation Scaling

Magnitude estimation scaling is a method of soliciting audience judgments while keeping restraints upon those judgments to a minimum (Meeland & Kaplan, 1967). The study participant is asked to employ an interior standard for a quality--attractiveness, for example. The participant may use any number system which comes to mind, so long as numbers increase as perceived attractiveness increases and to the same extent. Thus one subject may see Picture A as having an attractiveness equal to 1/4; Picture B as 10. Another subject may judge Picture A to have an attractiveness equal to 10, Picture B to have an attractiveness equal to 3500. The result is a set of numerical judgments from participants that go far beyond the three to seven steps of common perceptual scales--at least in terms of power to discriminate.

When the responses are analyzed, the researcher puts each score in ratio to the first judgment offered--yielding a ratio scale of attractiveness. In a study of the attractiveness of landscape photographs presented in opposite asymmetries the measure was used to estimate whether "indexing vector" or position of midline with respect to mass of object of interest (Dondis, 1973, pp. 92-93), is the better predictor of more attractive asymmetry. Results (Fletcher, 1979) indicated that direction of perceived asymmetry interacts with experience of the viewer, but that position of midline with respect to mass is a useful predictor of more attractive asymmetry.

Magnitude estimation scaling works best when participants are able to think about their judgments before recording them and when a series of judgments are required in the same study session. It is appropriate to study of still images likely to differ in subtle ways as judged by participants. It is not appropriate to such complex visual presentations as television or motion picture dramas.

Cloze Procedure

The early development of Cloze procedure was as a measure of readability (Wimmer & Dominick, 1991). When employed as a measure of memory or recall, Cloze procedure is well suited to television or film presentations in which specific memory of a rule or of an argument are desirable goals for the visual presentation studied.

The instrument for Cloze procedure is a copy of the verbal text of the presentation in which one out of every five words is removed. The study participant is asked to write in the missing words. The frequency with which blanks appear in the copy can be varied by the investigator to make the task easier or harder.

The strength of Cloze procedure as a measure of recall or memory is that it has high reliability. It works well in combination with other measures when the analysis will involve such multivariate routines as factor analysis, multiple regression, discriminant analysis, or canonical correlation.

Measures of Feeling

Few areas in the behavioral studies have occasioned more literature or controversy than that of human emotion. In many studies emotion is taken as a

generalized state; in others, it is conceived as a state of arousal with a cognitive label (Schachter & Singer, 1962). One of the difficulties is that for study participants to identify which emotion they are experiencing, they must use language, and the use of language may change the emotion either as it is experienced or as it is remembered.

An attractive alternative for capturing the affective reactions of viewers of images is the measurement of *feelings*. Recent work at Duke University has developed a series of reliable scales which reflect feelings as participants are able to share them. Unlike some other measures these scales differentiate weak and moderately experienced feelings as well as those that are intense (Goodstein, Edell, & Moore, 1989). The scales look like this:

Upbeat Feelings

Amused
Agree 5 4 3 2 1 Disagree
Carefree
Agree 5 4 3 2 1 Disagree
Cheerful
Agree 5 4 3 2 1 Disagree
Happy
Agree 5 4 3 2 1 Disagree
Playful
Agree 5 4 3 2 1 Disagree
Silly
Agree 5 4 3 2 1 Disagree

Warm Feelings

Affectionate
Agree 5 4 3 2 1 Disagree
Hopeful
Agree 5 4 3 2 1 Disagree
Kind
Agree 5 4 3 2 1 Disagree
Peaceful
Agree 5 4 3 2 1 Disagree
Warm
Agree 5 4 3 2 1 Disagree

Skeptical Feelings

Critical
Agree 5 4 3 2 1 Disagree
Disinterested
Agree 5 4 3 2 1 Disagree
Offended
Agree 5 4 3 2 1 Disagree
Suspicious
Agree 5 4 3 2 1 Disagree
Skeptical
Agree 5 4 3 2 1 Disagree

Uneasy Feelings

Sad
Agree 5 4 3 2 1 Disagree
Uneasy
Agree 5 4 3 2 1 Disagree
Lonely
Agree 5 4 3 2 1 Disagree
Anxious
Agree 5 4 3 2 1 Disagree
Regretful
Agree 5 4 3 2 1 Disagree
Concerned
Agree 5 4 3 2 1 Disagree

Scores on these scales are not only reliable; they are relatively independent of other measures. In studies of image composition they will provide good discriminators of the overall effect of changes in the relative position or perspective of objects in the image.

Tachistoscope

The tachistoscope--a device for controlled exposure to visual experience--is widely used in psychology and in reading research. A common form of tachistoscope appropriate for studies of visual communication is a slide projector equipped with a shutter which when activated allows a slide to be projected for a study participant. The activation mechanism permits the shutter to open for a precisely measured period of time.

The idea is that the tachistoscope allows the image to be seen in too little time for the viewer to rationalize or plan an exploration of its parts. Thus the first exposure of an image might be .1 second. After the exposure the participant is asked to report whatever she saw of the image. Then a second, longer exposure of the

image is presented and the participant asked, "What additional things have you now seen in the image?" (Dunn, Barban, Krugman, & Reid, 1990, p. 489; Zikmund, 1989, p. 282).

The data produced by this tachistoscope procedure are the mean accumulated length of exposure required for a particular visual element to be reported as seen. The sooner that element is reported by study participants, the more *prominent* that element is considered to be in the image.

The tachistoscope is useful in comparing images which are equivalent in purpose but different in the relative prominence the designer intends to give some feature of the composition. The steps from one period of exposure to another are necessarily rough. Investigators bothered by this limitation of tachistoscopes will want to investigate eye-tracking.

Eye-Tracking

Eye-tracking equipment is extremely expensive--so expensive, in fact, that most investigators rent the equipment from the Applied Sciences Laboratories of Waltham, Massachusetts--a part of MIT.

Eye-tracking devices record the movement of the eye as it scans an image. Most such devices do this by reflecting a small light source off the flat spot of the corneum. This fine point of light is then superimposed upon a video representation of the visual image viewed by the study participant.

In the early days of eye-tracking studies the study participant's head was held in a sort of vice, or the participant was asked to bite into a wax mouthpiece to hold her head in a fixed position.

The eye-tracking apparatus of today is much less demanding of the participant. A television camera and light source to record the direction of gaze during exposure to the visual image is located several feet away from the participant. The record of the participant's exposure to the image is a videotape showing the location of the point of gaze as a cross. Figures near the margin of the frame show the relative diameter of the pupil of the eye at each moment. A cross representing the point of gaze and other information are shown superimposed over the visual image being studied.

The videotape is then subjected to analysis by computer. Important areas of the visual image being studied are designated as boxes. The computer summarizes the entire exposure of the participant to an image by accumulating such numerical indices as the length of time before point of gaze reaches a particular box, dwell time or the cumulative time during which the point of gaze rests in each box, the number and length of fixations in each box, the number and degrees of movement for each saccade in each box, the number and duration of all fixations in each box, and the average pupil dilation in each box.

This is a large volume of information on the behavior of the eye during exposure to a visual image. Unfortunately, science falls short of the capacities of technology. We are not entirely sure, for instance, how the ratio of number of saccades to degrees of arc movement in saccades are related--nor what such relationships imply about learning or perception of visual images (see Groner, Menz, Fisher, & Monty, 1983).

At the same time, for an investigator these detailed records mean that differences can be measured between visual images that differ in relatively small ways. It is also true that dwell time typically enjoys a moderate to high correlation to reports of recall and affect related to the image. While eye-tracking studies have a history of nearly a half century, relatively few have been published. Most of these have been studies involving small samples. Large studies with many images in the analysis are now being undertaken, and the

technique is one that should interest students of visual images in the future.

Electrodermal Recording

Electrodermal recording--measuring electrical changes in the skin--began more than a century ago (Neumann & Blanton, 1970). The preferred electrodermal measurement method today is continuous recording of skin conductance (SC).

In SC measurement two electrodes are placed in a palm of the study participant. The electrodes are made of a silver/silver chloride mix; they contact the skin through a low concentration saline gel (.5 % N NaCl). A tiny voltage (.2 volts) is applied to the skin, and the ease with which the current passes is recorded digitally in a computer.

The skin of the palm is made a better or worse conductor by action of the sympathetic nervous system in response to central nervous processing of stimulation from the environment of the study participant. The mechanisms in the skin which respond to information processing are the walls of the sweat glands which become more or less permeable to the potassium ion--more permeable and more conductive as the individual takes in more information from surroundings (Fletcher, 1985).

So far as studies in the information processing of visual images is concerned, the most promising construct associated with SC is that of the *orienting response (OR)*. This system of ideas was born in Russian neurophysiology (Sokolov, 1963) and has been influential in the rest of the world in the past two decades. Various indices based on the OR have been related to common notions of *attention* and to *involvement* or *allocation of information processing resources*. The conditions in the perceptual environment of an individual which give rise to changes in SC have been summarized (Fletcher, 1985):

> (1) message features that to the individual are unpredictable (because they are novel, incongruous, inherently uncertain, or greater or smaller than expected in some respect); (2) message features that imply an obligation to act, either mentally or physically (because the receiver's name is called; a reference group norm is invoked; other previous experience involving threat or action is evoked); and (3) message features that are directly at odds with the policies or states then governing the receiver's behavior. (p. 99)

Allocation of information processing resources is indexed by the moment-by-moment average of SC levels by the research of a number of psychophysiologists (Dawson, Filion, & Schell, 1989; Filion, Dawson, Schell, Hazlett, 1991). This notion fits at least one definition of communication involvement: "Commitment of the central nervous system to devote attention to a message" (Fletcher & Shimell, 1989).

When mean SC is measured as an individual views the images of television or film, it represents the capacity of the images to dominate the experience of the viewer. When this average increases during viewing, the images are having greater influence upon the viewer, and vice versa.

The prospect of SC measures applied to studies of the imagery of new media promises new understandings of the time and persuasive vectors created by the visual components of multimedia presentations, enhanced television and virtual reality. The measures are highly reliable (reliability coefficients typically above .9) and extremely sensitive. Their application to the study of static images has not been extensive to this point, but in the few studies available the measures have performed well when time of exposure was controlled across the sample.

Summary

While the objectives of quantitative research on visual images do not at the moment warrant the experiment as principal study design, the techniques and rigor of experimentation have great appeal. Gradually the body of information about visual causes and human effects will justify a science in this area.

Fifteen years ago an earlier paper on this topic ended with these words, repeated here as a coda to this discussion:

But more important than new measures and new procedures, new curious eyes and ears need to scan the exotic terrain of visual communication, finding in it not only a Shangri-La for mystic contemplation and scholarly rapture--but a rational encyclopedia of inductively based generalizations which, when mastered, offer new views of human capacity to share both personal insight and collective dream. . .how we got to be this way. . .how we are shaping the visual universe. . .for our posterity. . .and for our own maturity (Fletcher, 1978).

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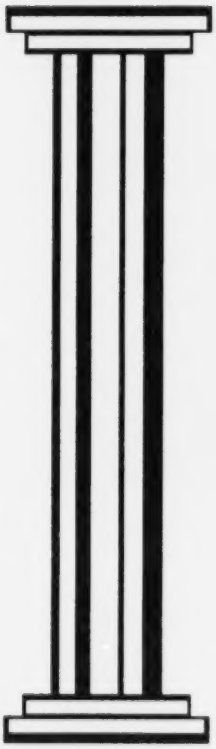


NEW VISUAL COMMUNICATION MEDIA TECHNOLOGIES

EDUCATION IN ELECTRONICS: A MULTIMEDIA METAPHOR

by
George Cambourakis, Eleftherios Kayafas,
Vassili Loumos and Ioannis Tsatsakis

Introduction

Education, by means of computers, especially since CAI (Computer Aided Instruction) was introduced in the late 50's, went through a lot of stages between success and failure and faced a lot of criticism. After thousands of computer installations in elementary and secondary schools (Price, 1991) and the relevant studies, educational software has been enriched with important assistance tools from multimedia technology.

Great importance is given to the definition of the educational material by teachers themselves, something that in the first steps of CAI applications had been misunderstood. Today, nobody doubts the positive results of the computer's involvement in education. Some of the obvious advantages are:

- immediate access in every layer of knowledge.
- unlimited time of occupation,
- flexibility in the choice of presentation media, compared with the traditional supervisory educational assistance tools,
- reduction of the educational time (Price, 1991).

Education in electronics is a representative case that combines almost all the methods met in a CAI application, such as:

- hypermedia/hypertext,
- drafting, animation,
- topology recognition (in the sense of connection analysis),
- drill and practice methods,
- tutorial systems,
- simulations, similarities,
- metaphors,
- knowledge representation.

Aiding tools are available by now, in order to build an educational environment that simulates the tasks and the skills met in an electronics laboratory:

Circuit Analysis, Synthesis and Simulation Software

All these programs use sophisticated features developing complex circuits, which otherwise would require a great effort. But as the complexity of electronic design is increasing, the corresponding theoretical concepts are becoming more involved and complicated. From the student point of view, the effort spent in drawing lines, busses, etc., as well as learning basic and advanced theory is quite necessary, but also time consuming and very difficult to understand. Therefore, these sophisticated tools are not always suitable as teaching aids for basic courses in electronics and electronic design.

Mathematical packages for Formula Editing and Processing. One could proceed with these tools by constructing equivalents of transformation formula, and using them parallel with other applications.

Instrumentation synthesis and simulation, using special software and hardware peripherals. It could be an excellent assisting tool for simplifying the required materials.

Drafting tools for image processing and enhancement .

Context-sensitive help markers, that can help the author in the construction of hypertexts.

Authoring tools and authoring languages. Although authoring systems are easy to use and can reduce dramatically the developing time, a certain amount of time is spent in learning how to use them and how to build complex tasks, in which case, a third generation language would be easier, faster, and much more flexible.

Evolutionary database systems, using object oriented structures.

Multimedia peripherals implemented with the appropriate software such as video controllers and sound synthesizers.

Programming these tools is not always an effortless process. A certain capability in programming is required to connect and combine all these discrete tools into an integrated and interactive environment.

On the other hand, such an implementation using all these discrete programs as background processes would confuse the author and overcharge the trainees with additional commands and menus.

Furthermore, no simulation system will familiarize the trainees with electronic circuits, as much as a real electronic laboratory, but such an approach represents an inexpensive and very attractive solution.

Architecture and interface design have goals in common, to create active, attractive and operative environments. This principal will be kept in this paper.

Goals and Strategy

According to the above thoughts, a good approach is to build some of these tools considering the level of utilization. We will use the chapter of operational amplifiers as a tutorial example in introducing novice students to electronics through a computer environment, in a form of *experiment pages*.

This allows teachers to prepare effortlessly their educational material and the students to experiment on the behavior of electronic circuits. They can change the values of parametric elements and observe the output in a graphical window. The application is composed of three discrete modules: *The Author*, *The Student*, and *The Examiner*.

The Author is an interactive module that facilitates the preparation of the educational material, creates pages from images of electronic designs, organizes them in a object- oriented database, and defines text parts from the above icons as parameters, in order to obtain further calculation capabilities on transient formulae functions.

The Student module contains an introduction to the base theory of op-amps, help utilities, examples, and reference educational sources. It allows the construction of user sessions in conjunction with the desired skills taking into account the user's capabilities and knowledge. It enables the user to experiment on preselected *pages* by changing the values of the electronic elements and observing the output. In this way the user defined values are evaluated as formal parameters in the transient formula. The result is shown in a appropriate graphical window (virtual instrument).

The Examiner finally creates a questionnaire on the logic of the circuit to examine the user's understanding of the educational material. The module watches the user's achievement and degree of understanding. It controls the answers by scaled criteria and redefines the skill level by adapting the user's session to his performance.

Not all of the implementation depends on teacher's analysis, choice of educational, material, and authoring. An

effort should be made to solve the following problems.

1. Database consistency against improper operations by novices.

2. Compatibility between various available peripherals (e.g., different screen resolutions, different CPU speed that influences the animation speed, etc.).

3. Data exchange, while switching between various tasks (considering the logical synchronization and the computation steps).

4. Standard approach for various tasks in order to reduce the required amount of code.

5. Automation as possible, of the embedding and calling images, executable code, and other binary sources (MS Access User Guide).

6. Configuration of the application into a network.

According to the above list, it was essential to distinguish the implementation of the three modules in two development layers. These layers are authoring and programming, bounded by the criterion of independence between programs and data.

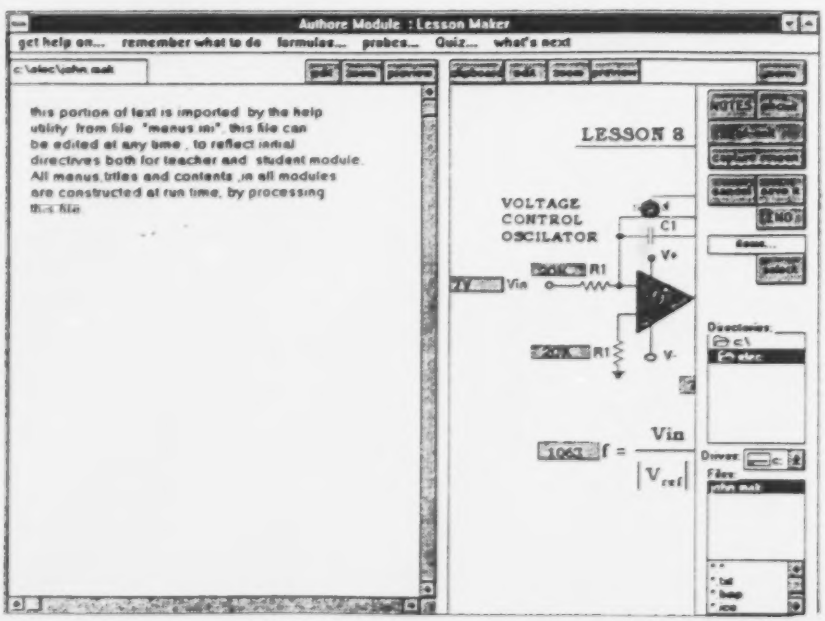
Authoring

The authoring layer is application specific and deals with the definition and implementation of:

- Data classification and structures (e.g., tables, indexes, trees, etc.).
- Authoring tools required for importing and processing data (forms, drafting utilities, etc.).
- Forms of the lessons (nodes in multimedia terms).
- Data capture for monitoring the student's activities.
- Protocols for data exchange between modules.

The diagram of Figure 1 is a representative form of the Authoring Screen.

Figure 1. Initial Screen of the Authoring Module


Authore Module : Lesson Maker
get help on... remember what to do formulas... probes... Quiz... what's next
this portion of text is imported by the help utility from file "menus.mi". this file can be edited at any time , to reflect initial directives both for teacher and student module. All menus,titles and contents ,in all modules are constructed at run time, by processing this file
LESSON 8
VOLTAGE CONTROL OSCILATOR
C1
R1
Vin
V+
V-
R1
Directories:
Drives:
Files:
Vin
$|V_{ref}|$

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As we can see in Figure 2, the metaphors refer to seven basic tasks: Circuits, visual formulas, formula processing, virtual instruments, assist, query-examination, and activity acquisition. A further classification of data processing (icons, text, and keywords) leads to icons tasks, hyper tasks, and context tasks.

Circuits and visual formulas consist of bitmap icons edited to improve their appearance and facilitate hyper area boundaries definition.

Virtual instrumentation is based on LabView® which allows the measurement of a series of different parameters on the circuit, as well as their visualization.

In the case of formula processing, input variables are linked with the appropriate icons of the visual formulas and circuits. That way, a new value of an input parameter enforces updating of all related screen and background objects.

A hypertext case sensitive help is available through assist. Query and examination follows the predefined links in a sequential order according to the skill level.

Activity acquisition is the task designed to capture the answers and estimate the level of understanding by means of some explicit rules.

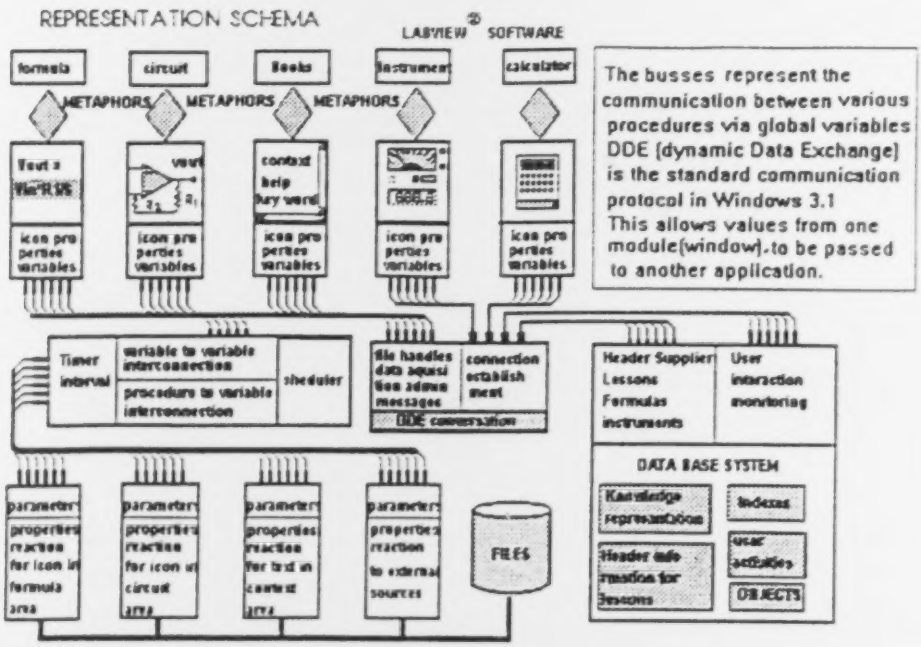
Programming

The programming layer deals with definition and implementation of instruction sets and procedures.

The instruction sets are used through the three modules in such a way that common tasks can share the same code.

On the other hand, procedures automate standard database tasks, reduce

Figure 2. The Structure of the Application



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interaction with the operating system, and implement the data exchange.

In the center is the scheduler that performs all the necessary tasks that deal with the interconnections. It:

1. Retrieves information about users and the appropriate lessons, or stores constructed lessons.

2. Opens files and retrieves the necessary objects related to that lesson.

3. Gives the appropriate values and properties to the screen objects and at certain time intervals, updates global variables according to implied logic.

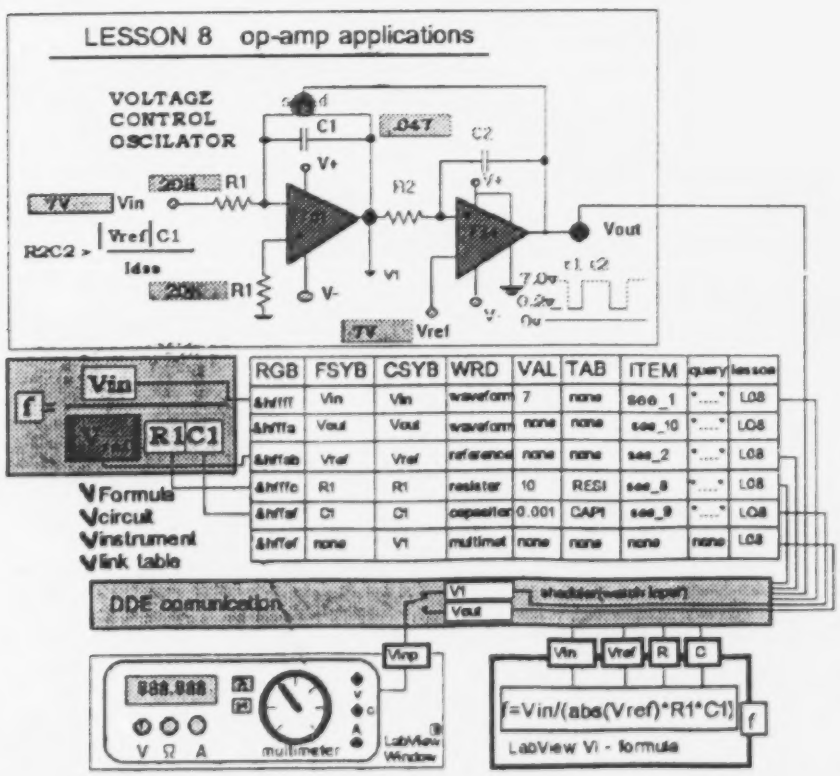
4. Establishes the communication with external applications (DDE method).

Finally, at run time, the scheduler is responsible for capturing the user's activities (mouse movements, key strokes, etc.).

According to an implied logic the scheduler interprets these activities into a tabular information. Any change to this information invokes the scheduler to check a table of values for integrity and to update the screen objects.

Figure 3 shows the database structure and all the necessary links between hyper areas, hyper-text symbols, and properties.

Figure 3. The Links Between Circuits, Formulas, and Instruments



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Implementation

As it was previously mentioned, Assist is a hypertext case sensitive help system. To improve its performance, text is kept as items in a choice menu that organizes them in tree structure by means of menus and sub-menues. The titles of items serve as context help for all the application.

A very convenient way to implement a link between selected areas and their context can be done by using the hex code obtained from the selected (in sequential order) background color (see RGB column in Figure 3). These values (which must be reserved for hyper areas) can serve as an index in the symbol table. This method leads in a very fast and convenient hash function. The hyper areas appear in increment tones of a color.

The student has to invoke the examiner (questionnaire is opened at the lesson's session). Selected links and titles (see Figure 4) of questions are retrieved according to skill level. The questions are presented to the student and he/she has to click inside the right hyper area as a response to the question, or he/she has to calculate a result of a function and paste the answer in the calculator's box. The professor decides if any help will be available to the student. The same table of links used for the association of hyper areas and hyper text is also used for the examination.

The Acquisition task is designed to capture the answers and estimate the level of understanding by means of some explicit rules: Instead of considering a particular programming approach, a more generalized structure is constructed. It behaves as an interpreter of key words and expressions embedded in a script file. These keywords include logical operators, arithmetic operators, functions, directives, and application variables (field names). A rule then could be constructed simply as a line in the script file:

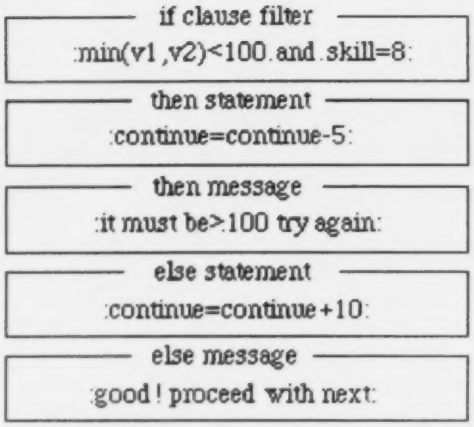

Figure 4. A Script to Implement a Simple Rule

The interpreter then is responsible to incorporate these instructions into the checking loop, in the form of macros and proceed with the control.

Figure 5.
A Script to Record Student's Score

By these means the teacher could construct without effort his/her own rules, without worrying about changing programs or adding new ones. Also he/she can obtain additional information, using the same structure, about user activities in a database table. As an example the above script file could contain a message for teacher purposes.

The Platform

- MS Windows 3.1® with the utilization of DDE. Dynamic Data exchange is a method supported by Microsoft Windows operating environment that allows two independent applications to communicate with each other in a client-server model and automatically exchange data.

- MS Access®, as database system for the examiner module implementation, MS Access Basic, as a programming tool for embedding user functions.

- MS Visual Basic® for stand-alone modules.

- LabView for Windows® (National Instruments Corp.), a graphical, visual programming tool for instrumentation (virtual instruments), such as signal generator (for drill and practice in students module), formula processing (by constructing background instruments as links to the formal parameters of transient functions).

Utilization of some Windows libraries (DLL) for screen capturing and construction of screen images.

Conclusions

In this paper we have demonstrated an integrated environment for education in electronics, both for novices and advanced students. Attention was paid to the role of the teacher. Course development time is reduced, to a minimum, without the utilization of special authoring tools and programming languages.

An effort has been made also to capture the user's activities in a flexible way so that a maximum interaction with the application can take place, both for the teacher and the student, with the minimum effort in programming.

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THE MULTIMEDIA FACTORY

by
Peter Capell

Abstract

Currently, multimedia systems suffer from a common problem: complexity. Nowadays these systems can incorporate a number of elements: intelligent diagnostics, computer graphics, digitized sound, digital or analog video, music, and so on. Most systems are created *ad hoc* such that the development method is discarded and forgotten soon after the system is created. However, with the use of existing technologies as well as those created in the development of the Piano Tutor, multimedia system development can be given a significant boost towards becoming a *production line* process.

Introduction

One problem in developing instructional multimedia systems is in structuring content. Most developers have the same types of questions: How do I order the ideas I want to teach? What would happen if I put *concept y* before *concept x?* Oftentimes a large curriculum can be daunting and the order and sequence of ideas is not obvious, or even linear--maybe the student should choose. The Piano Tutor project went down these paths and produced software to cope with the complexity of the tasks involved--from automated curriculum design assistance to computer-screen graphics development. The Piano Tutor's tasks were non-trivial because the curriculum consists of one hundred lessons which are executed according to the student's accomplishment of as many skills that are considered as prerequisites to and objectives of the set of lessons.

The *byproducts* of our development effort exist now as fully functional systems. It is my belief that the toolset is currently advanced enough to permit us to create the *multimedia factory*. We understand the elements required to engineer our systems, however, the process is still relatively undefined. We are on the brink of being able to systematically construct what Wenger (1987), described as knowledge communication systems.

Yes, we certainly have the constraints of limited resources and deadlines for projects to weigh against any heady development efforts, however I do not believe that it is resources and deadlines that are the actual constraints limiting the vision of multimedia systems. Instead, I choose to blame the process. Here is why:

In the 1980's there began in earnest the development of intelligent tutors. These systems could make simple deductions about the state of the learner and adjust teaching strategies or the curriculum, or both, to fit the system's best reasoning about the student. Unfortunately, the focus throughout the period, such as Meno Tutor, Buggy, Proust, and the Algebra Tutor (Sleeman & Brown, 1982; Wenger, 1987), often seemed not so much upon the learner as much as the pompous question of "Where's the intelligence?" My view as an educator and non-computer scientist was something like: ". . .it's just a computer program. It's as intelligent as its programmer." Unfortunately, the question really was about proving something about *artificial intelligence* more than making excellent learning environments.

All of this is not to denigrate the fantastic achievements of those systems. John Anderson's LISP Tutor exceeds the efficacy of classroom instruction by a large margin (Anderson & Reiser, 1985). So far, the Piano Tutor has been able to move

its limited sample of students through one year's worth of piano instruction (*one year's worth* as judged by two professors of music on the project) in less than a third of that time.

In addition to the success of these systems, there was the development of a new idea--using a computer as the modeling environment for specific learning paradigms and theoretical examination. Computers became laboratories for the evaluation and testing of ideas in cognitive science.

Beside these interesting and profound developments in the intelligent tutoring community, was the continuing practical application of computers and video to conduct training. The emergence of affordable computer video technology created a whole new paradigm in video and computer-based instruction. For people *in the trenches* doing *real* training and instruction, computer video provided an exciting new platform upon which to build simulations, surrogate travel, surrogate worlds, and so on. We saw the Aspen Project, and *Discovision* and we learned all about levels 0-4, struggling mightily to make sure we understood them. Specifically, I can remember holding to a mental model that level one was *less than* level four until I met Ed Schwartz at the University of Delaware and saw a beautifully level one application of videodisc in the music series developed there. There was a lot of excitement in this period where new doors were opening to machine-based education at unprecedented rates.

In fact the rate of *door opening* has not really settled down since, and this has turned out to be somewhat of a deficit. Endemic to the information age is the profusion of options. Now we have DVI, CD-I, videodisc, digitized voice, and MIDI. We have multiple possible implementation platforms with multiple configurations per platform. We have a variety of new and improved authoring tools as well. And while there is no question that the tools have improved, there is still a question of what these tools are building. Most often the systems being built are either *exploratory* or *prototypical*--intended either as research projects of proofs of *cutting edge* technologies. Either that, or we have a mix of applications that are not really stretching technology at all--point of purchase applications and buyer assistance guides that are little more than databases with fancy graphics. These systems are useful, however we need now to consider bringing what is now cutting edge into the world of the commonplace, and I believe we are currently on the verge of being able to do so.

There are many important obstacles to this notion having nothing to do with available technologies, not the least of which is money. The Piano Tutor cost $200,000 per year for three years, not including three years before the project was funded which were used for foundation research, planning, and the effort to obtain grant money. A bigger obstacle however is perception. I am hoping that we are moving towards a time when these environments will proliferate on their own, based on a common understanding of their value. In other words, it will be understood how to build them, and they will be built because their value is taken for granted.

In order for this wide ranging *understanding* to happen, the proper mix of elements must take place between the diagnostic power of the intelligent tutor in addition to multimedia and training-type systems. And their needs to be a relatively standard process for their development. There needs to be a multimedia factory, consisting of the tools and methods to build these complicated systems quickly with replicable success.

On the Piano Tutor Project, I believe we developed a few useful tools and made some discoveries that could prove useful in building the multimedia factory. Before I describe those, I will provide background on what the Piano Tutor is.

Piano Tutor

The Piano Tutor is a multimedia workstation that teaches basic piano playing. The system employs real-time music technology, expert tutoring, and videodisc. In developing the system, a curriculum analysis system was developed to model the curriculum in order to test the integrity of its instructional design.

The Piano Tutor operates in two modes; as a teacher and as a silent observer/evaluator during practice. In its Teaching mode, Piano Tutor guides students through a dynamically changing lesson path with appropriate interruptions for suggestions and corrections. In its Practicing mode, Piano Tutor provides guidance without interruptions, providing students with graphic evaluations of their playing, among other capabilities. Students may work with a teacher or by themselves, receiving expert piano instruction at a pace set by their own ability.

Piano is composed of a computer connected to a velocity sensitive, piano (MIDI) keyboard, MIDI synthesizer, and videodisc controller. The computer serves as the controller for the workstation and as a music score display. The videodisc is used to provide detailed visual and verbal instructions, the keyboard is the student's input device, and the synthesizer allows the student to hear what he or she has played.

In order to evaluate the student's performance, turn music score pages at the appropriate times, and accompany a student's playing, the system recognizes and evaluates keyboard input. The MIDI interface reports the notes played, but the heart of the system is the pattern-matcher. The matcher allows the system to identify where the student *is* in a score, even though he may be playing at varying rates of speed and playing many wrong notes. The information gathered by the pattern-matcher is used to evaluate the student's performance, accompany the student, and coordinate the display of the score (*turn pages* on the computer screen).

Although the practicing and teaching systems are separate components, each has similar software building blocks:

- pattern-matcher--matches music performance with music score in real time,
- digital recorder--records keyboard performances in digital form,
- playback--plays recorded keyboard performances,
- performance evaluator--conducts evaluation of student performance,
- score display systems--handles all score displays,
- intelligent decision maker--determines the appropriate lessons to execute relative to immediate student input from the keyboard and student performance history,
- videodisc controller--handles video-disc interactions,
- accompanist--provides accompaniment for any prerecorded score.

The system provides direct instruction in its teaching-mode and passive criticism in the practicing-mode. In the teaching mode, Piano Tutor actively teaches new concepts, evaluates the student's performance, and directs the student's progress. The practicing system provides passive visual criticism to guide the student in evaluating and correcting errors without interruption during play.

In teaching mode, Piano Tutor instructs beginning piano students in basic performance skills. The current curriculum

provides approximately one year's worth of piano instruction (Dannenberg, Sanchez, Joseph, Saul, Joseph, & Capell, 1990).

The Curriculum Analyzer

Instructional design for an automated, non-sequential lesson planner proved to be a solvable but non-trivial exercise (Capell & Dannenberg, in press). Piano Tutor's strategy in coping with this problem comes directly from the most basic principles of instructional systems design (ISD), (Dick & Carey, 1985). Two of the most basic ideas of ISD are: (a) Students are evaluated according to observable skills, and (b) students must fulfill the requirements of less complicated skills before moving to a new skill. This means that any lesson taught by the Piano Tutor has prerequisite skills and an objective.

Observable skills are distinguished carefully in ISD to avoid the uncertainties of ad hoc curriculum writers who specify their objectives with comments such as: "The student will understand how to read at the first grade level." The ISK model is an inherent challenge to these kinds of vague goal statements requiring detailed information such as: "What does 'understand how to read at the first grade level mean?'" The instructional systems design expert will always want to see an operational definition for any goal statement. In our example, the ISD specialist will ask: "What must the student *do* in order to demonstrate the ability to read at the first-grade level?" Will the student have to read "War and Peace"? Or will she only be required to read a few sentences? ISD is all about specifying and verifying learner behaviors as evidence of their comprehension, and then adapting instruction to adjust to weaknesses.

In one sense, it is easier to implement a model with ISD's rigor in a computer system because people rarely have the fortitude to be as exacting as they need to be. One instructional breakthrough for us was the development of an analysis model that helped us to determine whether its prerequisite skills were always met in a network of one hundred lessons. The problem is that Piano Tutor scores skills, not lessons. So by obtaining certain skills, one gains access to new lessons. It is not easy to figure out in one's head however, whether or not there may be *holes* in the curriculum, where for example a lesson teaches a skill that is not used by any other lesson in the curriculum, or where a lesson is *cutoff* from the rest of the curriculum because its prerequisites can never be met.

The curriculum analyzer turned out to be central to the development effort, permitting us to create lessons and skills, simulate them, and determine whether our curriculum was complete unto itself. It also showed the utility of the systems approach to instructional design in a very formalized way with practical results. Further, any system of like complexity will have to cope with this problem. We believe that our method is sound, complete, and replicable for systems of high complexity with large number of lessons.

Video

The next most difficult problem in my area of the Tutor was the production of a videodisc to accompany the 100-lesson set. We wanted only one videodisc, so there would be no need to change discs in the middle of curriculum. Since the system would be executing lessons with many possible orderings, the student could potentially wind up changing discs again and again as the system would require video stored on either of the two discs. And so our effort began to try to put as much as possible onto only one disc. Hopefully this need will soon be oviated forever with DVI, CDI, or some other variant, but in our experience coping with this issue we discovered some useful videodisc production techniques that will have implications no matter what the video storage medium.

We learned to script our lessons individually and to time them. We had the scripts in electronic form, and so these were entered into a database. Perhaps the most time-intensive aspect of video shooting is changing camera angles. Having each script in the database, we encoded each paragraph with a marker as to its angle. In other words, some paragraphs would be marked *overhead*, others *left side*, and so on. This enabled us to run simple queries to the database to extract all the scripts with a side angle or all the scripts with an overhead shot for example, enabling us to do the action and reading for each *script cluster* leaving the camera in position. This saved a lot of time. Given the modular nature of the system and the sheer number of lessons, had we shot in script-by-script fashion moving the camera in order accordingly, we would easily have spent weeks accomplishing what took only three days otherwise.

Additionally, digitized voice saved us enormous amounts of videodisc real-estate because it permitted us to repurpose portions of the disc just by silencing the audio portion of the disc and playing the digitized voice synchronized to the same video as needed. Without these efficiencies and methods, our effort would certainly have been lost.

Mixing Multimedia Elements

Although there are now many multimedia event schedulers on the market, this was not so when we were developing the tutor. A member of our team wrote a multimedia timeline program that permitted us to integrate video, digitized audio, MIDI, and screen graphics. The system provides the user with a timeline onto which events are placed, so that at time zero, a video presentation would begin, then a graphic on the screen appears with accompanying voice over, and so on. Thank goodness, these systems are now widely available as commercial products such as Authorware™.

So What?

This is the question that researchers in any field should be asking at every moment. The importance of any of the elements described above is not contained in any one of them, but in all of them as a system. Currently there is an explosion going on in multimedia, especially in the use of digital video. Systems, such as "From Alice to Ocean" (Dannenberg, et al., 1990), provide users with beautiful graphics and an interesting interface to navigate, but we need not stop here. In the future these beautifully crafted systems will incorporate user diagnosis and intelligent feedback. We now have the elements in place to bring about what the early attempts at programmed instruction could not--a truly gripping learning experience using the best of modern technology.

The Multimedia Factory

And so what is the multimedia factory? A factory is a cohesive set of operations that are dedicated to the creation and assembly of a finished product. In other words, lots of efficient operations cooperating to produce some sort of widget.

Why a factory? As multimedia aficionados, we all want these efforts to succeed. It is an exciting technology that we know in our hearts is going to sweep us into a future of wealth and happiness--or at least we hope. Our big obstacles are creation and development costs--costs in resources, time, and money. My argument is that we are still spending far too much time on the inefficiencies of learning curve, not because of our misunderstanding of new technology, nor because we are valiant explorers, but because of inefficiencies of process.

On one hand we could say we need a factory to keep up with the tide of events. All of us have seen technologies that have seemed to take inordinate amounts of time to develop--consider how long videodisc has been around. And so we need the

factory because of the obstacles to progress that still haunt our efforts--cost, time, and complexity. We need the factory to help us to quickly create modules that can be assembled into larger components.

If systems go the route of greater complexity as I predict, we will need the factory if only to keep up with the tide. But if things do not take off as I expect, and we want to *create* the future, we will need to have the factory to convince our funding sources that we can produce systems with broad functionality for relatively low cost.

Conclusion

The reason for my excitement at this moment in time is that I believe the world of multimedia and knowledge systems of this kind are at a point where they will be *manufactured* as products instead of being explorations in and of themselves for academic ends. There really has been a lot discovered in the development of these video and computer-based interactive systems over the past ten years, and I believe it is now time for advances in their creation to take hold.

And so the questions that will press the multimedia community in coming years will be the issues of defining process. How are these systems created? Which parts are gruesomely time consuming? How can we automate or standardize these? What will be our general development strategy?

As a developer in this field, I sincerely hope that we will be able to capture our lessons learned so that the process of multimedia development will become standardized enough that we can consider more radical extensions including advanced intelligence instructional systems, and so on. I would like to see stunning interactive systems with the ability to provide instruction in complex domains so that students of the next generation cannot pull themselves away. We are now at the point of departure.

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MULTIMEDIA AND MULTIETHNIC LEARNING: VISIONARIES AND ILLUSIONARIES

by
Ann Cunningham

Have you ever been at a multimedia show augmented with a host of high-tech equipment where you thoroughly enjoyed the show, but do not remember what it was all about? And did you ever wonder why that is?

Chances are, the show was created by a team of equipment experts with a flare for showmanship, but who lack expertise in visual communication and learning. Today, many multimedia presentation techniques adopted for instructional purposes have similar format and style. They somehow give a false vision that the more glamorous the show, the better for everyone. They are the illusionaries in the educational presentation business.

In order to create an effective technology-based presentation, the creator must have a clear vision on the many aspects involved in the development of a show. A visionary will identify characteristics of the audience, organize presentation content appropriately, and match them with the technological tools best suited for specific information presentation.

This paper introduces the concept and role of multimedia presentation, and investigates implications of its uses and misuses in the learning environment. Additionally, guidelines are provided for those who plan to integrate various types of instructional tools to enhance learning.

Multimedia Defined

The term Multimedia is interpreted in a wide variety of ways depending on the interpreter's prior knowledge and experience. A librarian may consider a CD-ROM database installed at a computer workstation a multimedia station. A full-service Learning Resource Center director may insist that a true multimedia presentation requires a host of innovative technological tools such as a laser disc player, camcorder, voice synthesizer, video board, and audio board, in addition to a computer workstation with a gigabyte CPU and Super VGA monitor.

The simple truth is, multimedia means a collection of two or more presentation mediums of any type. Generally speaking, a presentation medium is a vehicle (print/non print) or mechanism (projected/non projected) to deliver information. It encompasses a broad range of materials and equipment.

Role of Mediated Presentation

Depending on the purpose and target audience, technology-assisted presentations may be categorized into three main types. They are: *Show and Show*, *Show and Tell*, and *Show and Sell*. Although they may not have distinctive features which can be identified as such, one can easily sense it during the presentation through the narrator's tone of voice, type of visual/special effects, and orientation of information.

Show and Show usually shows off their "stuff" without much thought in planning or goals to be achieved. The main purpose of such presentations, often fast-paced attention-getting image sequences with upbeat soundtracks, but without noticeable script or verbal information, is to entertain or impress the audience. Demonstration shows are prime examples. This type of presentation is rarely suitable as a tool to convey instructional information.

Show and Tell, on the other hand, has a story to tell or a message to convey. The audience may or may not agree with the story or message, but that is entirely beside the point. The topic of the presentation may be on religion, politics, or other special interests and events. Its content and method can be instructional and it is widely used in classrooms, especially for young learners.

Finally, *Show and Sell* has a clearly defined purpose or objective. The presenter must convince the audience, and prompt an immediate action by having the audience agree with the message being presented. Commercials are prime examples of this type of presentation. Learning activities such as debates and panel discussions can be transformed into this type of presentation by emphasizing the importance of current issues of differing viewpoints.

Teaching and learning is a cause and effect relationship between the instructor and the learner. Figure 1 illustrates the role of various media in an educational setting where it can be utilized to support and strengthen the interaction between the instructor and the learner. Depending on the teaching methods and media selected by the instructor, the outcome could vary significantly. Teaching methods procedures selected to help learners achieve the prescribed objectives through internalization of information presented. Media, on the other hand, are vehicles that deliver instructions between a source and a receiver. A particular medium may produce different results depending on learner characteristics such as the size of group, prior experience, and type of learning tasks.

Multimedia as Instructional Media

Instructional media is a set of tools or materials adopted for learning. Some technological tools are better suited for learning than others. While each medium has its advantages in conveying information, not everyone learns efficiently with techniques selected by the presenter. Therefore, it is imperative to examine positive and negative qualities of each medium to be adopted in order to ascertain the potentials and limitations.

Figure 1. The Role of Presentation Media in Learning

Figure 2 illustrates how a typical technology-based multimedia station is designed. This system, if adopted effectively, would accommodate both the individualized and group instruction for a wide variety of learners and topics. More often than not, the selection of the technological tools are made by teachers not based on the students' needs, but as a way to substitute an unprepared lesson, or a desperate attempt to stay current in

the field of instructional technology. Teachers sometimes feel left out by not becoming a part of all the hooplas in the marketplace, and try to 'dabble on' this and that. Such approach will produce meager improvement, if any, in final learner achievement partly because it relies on patchwork rather than holistic curriculum.

Each ethnic group possesses unique qualities in how they react and relate to different sources of information. Thus, there exists multiple learning styles within a group of students who study the same learning content. This multiplicity generates compound effects on the learning outcome as each medium is added as a delivery tool for instruction. A visionary takes these factors into consideration when designing and developing learning activities for a group of multiethnic learners.

Visual Communication and Visual Learning

Educators and presentation professionals are keenly aware of virtually limitless possibilities of multimedia-oriented presentations. Nevertheless, just *putting together* a show simply will not do in today's complex learning environment. We live in a Global Society where the instructor must deal with a multiplicity of effects of socioeconomic, cultural, and linguistic differences. Furthermore, certain groups of people may be less opted for, or intimidated by the *gadgetry* employed to make a presentation.

The majority of technology-based multimedia learning activities are composed of pictorial images. Pictorial images are the basis of visual

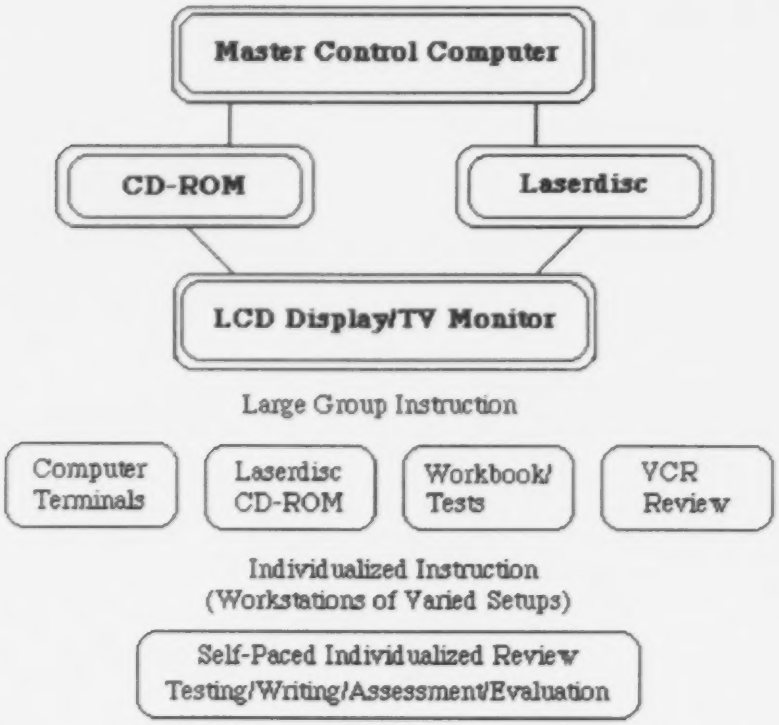


Figure 2. Multimedia System

communication which influences visual learning. Therefore, to optimize visual learning, the presenter must be able to integrate tools and materials for successful visual communication between the information source and learners.

This can be accomplished only when the media reflects the accurate level of audience visual literacy because a picture that could be worth a thousand words can also become a thousand confusions if not presented appropriately. This factor is especially important to consider in the areas where an influx of newly arrived immigrant children begin their schooling.

While there are visual learners who can easily transfer pictorial images into verbal information, there are verbal learners who feel the pictures are in their way of information processing. As a consequence, some individuals would rather read a book than see a motion picture to learn a story, direction, or events. It all depends on how each individual differs based on their prior experiences in terms of pictorial images and symbols. It is up to the presenter to make a careful analysis and assumptions before launching a graphics presentation project. The following are some of the aspects to be considered when planning a visual learning activity.

Information Density

The amount of information, either verbal or visual, in one projected visual (approximately 20 words per page or screen) or one presentation segment (approximately 20 minutes) should be observed, to insure proper digestion of presentation. The larger the number of words or longer segment of the presentation, the less effective the presentation will become because the audience will lose interest and the ability to concentrate. Furthermore, projected presentation should be used to convey key ideas and concepts. If additional information needs to be provided, it should be in the form of handouts or reading material.

Information Indigestion

Many of the multi-mediated instructions are driven by a nonlinear random-access information linking technique through the use of an authoring tool such as Hypercard (Macintosh), LinkWay (IBM), or Toolbook. The techniques often lead to an excessive branching which cause the learners to become overwhelmed by the amount of information offered to them. Hence, they become completely lost within a segment of instruction. Worse yet, they are unable to relate one area of topic and subtopic to another. As a result, the learners are unable to digest the data being presented.

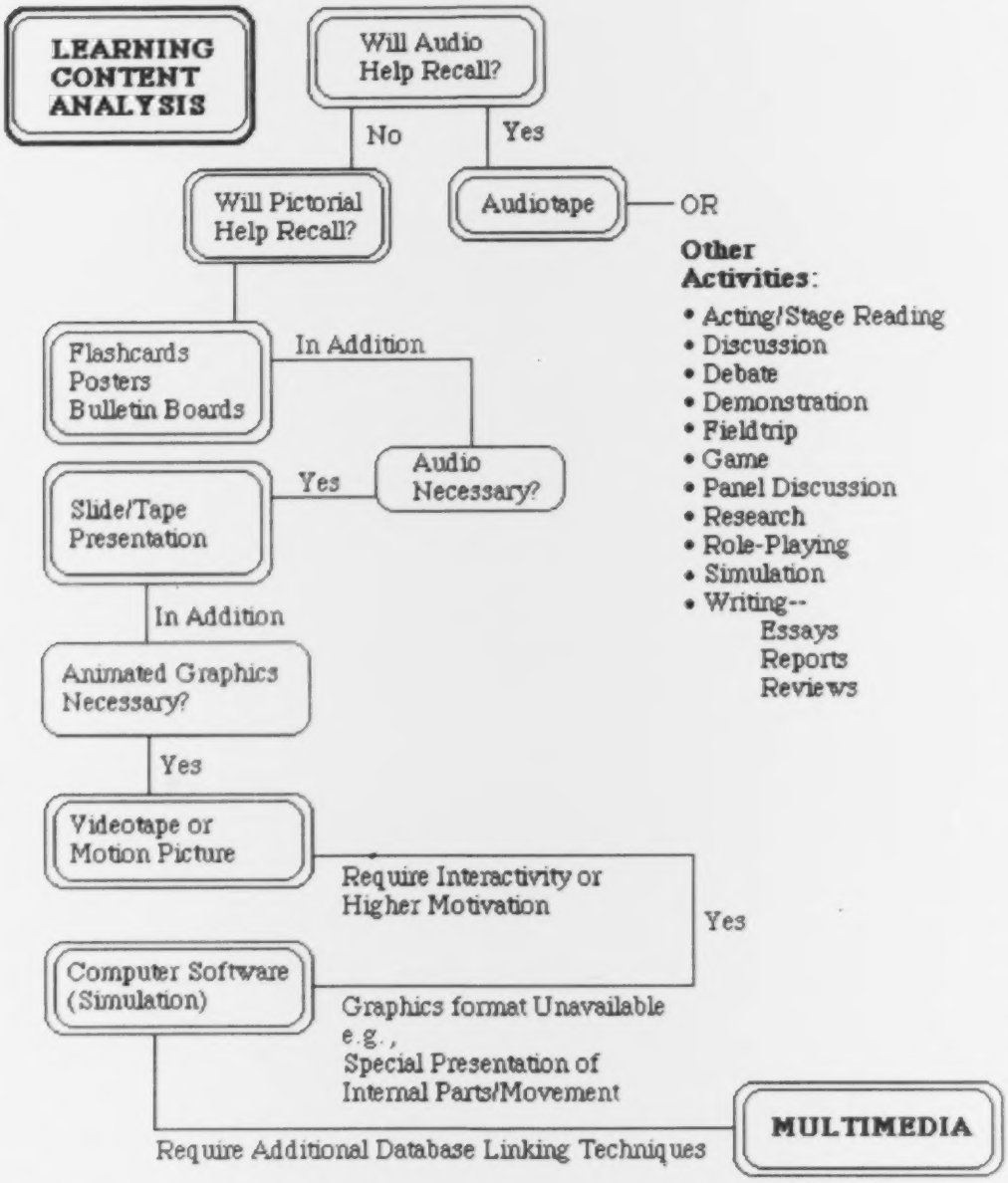
Visual Noises

When dealing with graphic images, the project/program designer should avoid embellishment graphics (pure decoration) whenever possible, especially with older audiences, because those images and symbols can become excess baggage or visual noise in one's cognitive process. They are like a jumble of meaningless words that can be very distracting. Embodiment graphics, on the other hand, are pictorial elements that support and supplement the verbal information being accompanied, which are useful in clarifying similar concepts or ideas.

Instructional Design

Rather than selecting a medium and finding a way to use it, one should focus on the learning content analysis and ascertain the level of complexity of the information. Among media buffs and professionals, there is a tendency to make simple things much more esoteric than they need to be by trying to present the same information through a different medium. Such approaches often lead to an overkill.

Figure 3. Learning Content Analysis



Gagné, Briggs, and Wager (1988) developed a flowchart to demonstrate how certain types of medium can be selected by examining the learning content. They provided a systematic approach in examining the efficacy of learner outcome through a careful analysis of the design and development of instruction. Figure 3, developed by the author, which is based on Gagné and his colleagues' principles in instructional design, is a diagram that illustrates the criteria on how to reach the decision in selecting multimedia as a delivery mechanism.

According to this diagram, it is entirely possible to achieve the same level of learner achievement by using flash cards as opposed to a computer drill/practice program. The use of computer software, therefore, should be considered an alternative or supplement to the main teaching methods rather than for use in place of planned teaching activities. It is also important to note that there are a variety of other human-interactive activities that can be more stimulating, thought-provoking, challenging, realistic, and cost-effective than media learning. Technological media should be called for only when necessary.

A similar approach to this process is known as Learning Task Analysis (Braden, 1988). He maintains that a person who designs learning activities needs to undergo a concept mapping by: (a) Examining the learners' cognitive and physical makeup, (b) juxtaposing the findings onto the learning events, and (c) implementing content-specific learning tasks. This is a crucial procedure in facilitating visual learning where visual-verbal translation is to take place through meta-cognition.

Development of Technology-Based Curriculum

There exists a consensus among theorists and practitioners that the current mediated instruction is in need of modification to accommodate growing student populations with multifaceted multiethnic backgrounds. The main focus of the technology-based education should be an ideal matching between the learners, instructional materials, and tools that deliver the most efficient learning.

A plethora of research studies (Kulik, Kulik, & Cohen, 1980) support such need by emphasizing the importance of Instructional Design and Development. Clark (1983) reiterated the fact that a presentation medium is nothing but a delivery vehicle of selected information. It is up to the user (instructor/presenter) how to utilize them. Equipment will not make any student learn better unless it is carefully chosen based on various factors that make up the learning environment.

Heinich, Molenda, and Russell (1992) made an in-depth analysis of the systematic approach where they enumerated necessary steps to be followed to deliver an effective mediated instruction. Designing and developing mediated instruction requires a team effort of experts from the instructional design, visual communication, teaching community, and creative arts. The person in charge of the entire project development must have a clear vision of what will work.

Conclusion

On the contrary to many who believe that technological tools would solve virtually all ailments of today's educational systems, insurmountable problems have been created by not knowing how to emulate the tools with specific learners. A key to the success in multi-mediated instruction is a clear understanding of each component. The equipment is only as good as the individual who knows how to utilize it to its full potential. Otherwise, the only reflection of multi-mediated learning would be just the multiplicity of number of equipment utilized.

The process of selecting the most effective media involves a careful analysis of: (a) Learners' prior experiences, (b) teacher competency in instructional technology, (c) techniques in content organization, and (d) teaching strategies. In addition, an instructor or presenter needs to make a periodic examination of (a) availability of equipment in working order, (b) trained personnel who can provide technical support for a complex presentation, and (c) environmental layout to insure sensible seating arrangements, proper equipment placement, and adequate supply of outlets and ventilation.

Figure 4. Development of Mediated Instruction

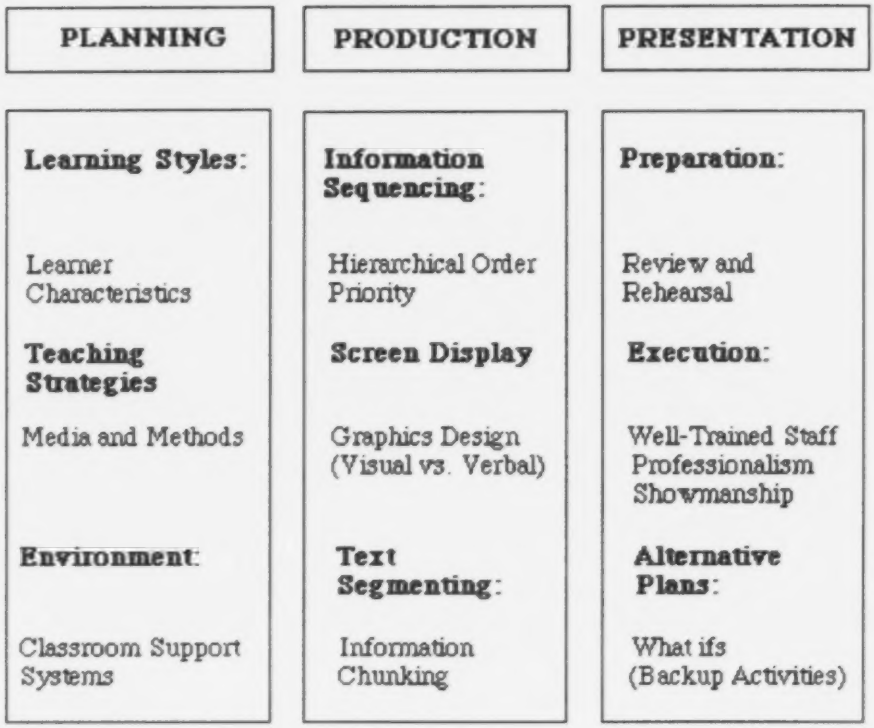


Figure 4 is organized as a review of what has been discussed, and to give an overview of the entire process in the development of technology-based learning. The process consists of the three main steps: Planning, Production, and Presentation. An important phase, Evaluation (Formative and Summative) may be added to this illustration. The purpose of this step is to examine areas to be improved or eliminated (partially or entirely) in future presentations.

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THE REWARDS OF VISUAL LITERACY: AN ARTIST'S PERSPECTIVE

by
Deborah Curtiss

Introduction

In 1972 when I began teaching drawing and painting at the Philadelphia Museum of Art, I was startled by my students' inability to talk about visual experience or to understand me when I spoke about possibilities of visual expression. Word and image seemed more in conflict than as two cooperative realms of inquiry. Thus my research began into what I eventually learned to be a significant part of visual literacy. The courses I developed and taught, and the book I later wrote, were mutually reinforced by, and reinforcing of, my work at the easel. I found visual literacy and all its ramifications to empower all of my studio and classroom work. It awakened me to new ways to think about visual experience, for example, to recognize the gap between intent of the maker and the message received by the viewer. I became not only more accepting of differing interpretations, but encouraged them.

Thus, as an artist, I came to understand visual literacy by an indirect route. While I consider that my study of the topic has been life long, and I began formal art training at age 17, I did not learn the term, visual literacy, until 1977 when I discovered Donis Dondis's (1973) book, "A Primer of Visual Literacy". This was in conjunction with teaching a course of my own design, Visual Awareness, at Temple University in Philadelphia. It was another ten years, after publishing my own book, "Introduction to Visual Literacy" in 1987, that I learned of the I.V.L.A. As a result, I have a perspective that is somewhat different from many members of I.V.L.A., but no less encompassing. I shall therefore begin with a brief overview of my perspective in order to establish a shared concept of this complex and fascinating topic.

What is Visual Literacy?

As with all things visual, visual literacy by nature defies exactitude, but in coming to terms with it, I and others borrow from the accepted definition of verbal literacy: the ability to speak, read, and write a language. If we accept the premise that visual statements--whether in the form of paintings, sculptures, buildings, park-spaces, ordinary objects, posters, films or videos--do communicate, the model serves us well. Let me explain.

Seeing objects, so to navigate ourselves in the world without bumping into them, entails a constant visuospatial dialogue between us and common reality. This process is as basic to us as is speaking--most of us walked before we talked. Navigating in the world, therefore, may be considered the visuospatial analog of speech. The ability to receive communication from visual statements, whether it is information, ideas, or esthetic fulfillment, so to understand and appreciate visual expression, can similarly be regarded as analogous to reading. The ability to create visual statements in at least one medium--whether as basic as sketching and taking a snapshot, or as complex as making a film or designing a building--can be considered analogous to writing.

Most of us here, however, will not claim that visual literacy is a literal or literary concept. Nor is it an attempt to make literature out of visual expression. Rather, by using the model of communication, and the notion of acquiring visual skills and acumen just as we acquire skills of reading and writing,

we provide a way to think and talk about visual learning and experience. It becomes, moreover, a way to bring the verbal and visual together.

In summary, and I paraphrase I.V.L.A.'s founder and mentor, Jack Debes, a visually literate person is one who can identify, analyze, interpret, evaluate, and produce excellent visual messages.[1] These abilities are, I posit, basic and central to being an educated person at the end of the twentieth century, for at this time of proliferating visual communication, if we cannot see critically, can we really claim to be able to think critically? It is my thesis that visual literacy, at this juncture of technology and knowledge, must become an integral and active part of every person's communicative lexicon.

With a tremendous proliferation of visual communication, however, I find myself too frequently affronted with visual clutter, indifference, and ignorance. It is as if that which is essentially visual: The keen perception, the assessment, the endeavor to develop and express an *esthetic*, is ignored or overlooked. How, when this is perhaps the most joyful aspect of visual communication, can we continue to ignore it?

Visual Ignorance

Let us look to the roots of visual ignorance. When children are taught to read, write, and compute, their senses as significant learning tools are often suddenly ignored, neglected, and left to fend for themselves. When one considers that from birth a child learns almost entirely through instinctive sensory exploration--through touch, taste, smell, and sound as well as vision--this sudden neglect, virtual denial of the senses after age five or six, might be an act of violence, one that violates essential aspects of our beingness. One would hope that educators or psychologists would have recognized this oversight, yet, to my knowledge, little attention has been given to the possibility that learning disabilities may stem from this neglect of sensory development. Even in perception theory, sensory learning has been more interesting to study than to teach. (As far as I can tell, this neglect is worldwide. If anyone knows of a culture or place in which sensory education is actively nurtured, I would certainly like to know about it.) As *we* are educated, so we educate, and few are acknowledging or taking responsibility for nourishing the fundamental hunger that our young people have for sensory stimulation and integration.

Except, that is, for the enterprising media and entertainment moguls who exploit this voracious hunger by providing a barrage of sound and sight. From Saturday morning cartoons to boom boxes, video games, MTV and the RAVE rage, a majority of our young people are bombarded and desensitized more than they are educated. The result may be, rather than nourishment of the sensory craving they feel, anesthetization, or the establishment of addictions that may actually prevent growth of keen and sensitive perception.

News Possibilities

With the new technologies available for research and development as learning tools--such as interactive digital or computerized television, VCRs, teletexts and teleconferencing, and video discs--we have a daunting array of possibilities. The challenge to learn media languaging systems and educational potential is demanding, and those of us who are now devoting our careers to visual technology often find it difficult to make time to actually view the images. As we integrate visual media in education, let us keep at the forefront the fundamental importance of sensory learning and its centrality throughout education. Historically, the arts have served that purpose. More often than not today, however, the arts are considered by anyone other than art

[1] John L. Debes, Founder of the International Visual Literacy Association, 1968.

professionals and majors to be a fringe benefit, and educationally expendable.

Perhaps because there seem to be no rules, logical or otherwise, beyond the limitations inherent in materials and technology, many individuals, despite their high level education, find visual problem-solving and esthetic judgment easier to dismiss as unimportant than address as the basic forms of inquiry and expression that they are. The truths of quality and excellence have to be discovered, usually by devious and improbable routes, and such an uncertain process terrifies many of us. Visual thinking is sophisticated, challenging, and exciting, for visual problem-solving both incorporates and transcends the dialectic, utilizes, by necessity, the scientific method, and not only employs all models of artificial intelligence being explored today, but inspired many of them. Visual literacy educators therefore have a responsibility to be sure their students are grounded with the basics, the basic verbal and visual vocabularies that will provide a foundation for visual education and expression in all media and at all levels.

Basic Visual Literacy

As part of *Strategies and Infrastructures for the Future*, I propose a course of study in basic visual literacy. It would include a combination of readings, visuals, lectures, discussions, and experiential studio-type, hands-on, explorations. The teaching of history and perception, the *reception* of visual statements, is integrated with visual expression, the active making of visual statements.

In coming to understand visual statements, whether in a museum, at work or home, or on television, one knows that there is a difference between form and content. In most curricula today, learning about visual form takes place primarily in studio art courses, and content study takes place primarily in art history and communications courses. From the perspective of visual literacy, these two basic facets of visual messages are learned and experienced as interactive and synergistic, and as relevant to our being in the world.

While studying excellent and noteworthy works of art of the past, or contemporary expressions of the present--learning about the meaning, the context and significance of the work--the student may perform graphic analyses of magazine pictures in order to learn about and ascertain the use of the visual elements, the alphabet of visual expression.

How the elements are combined is the grammar, the compositional principles of visual communication. Students learn to analyze visual statements in the classroom, at galleries, and at home for their underlying designs: orientation, balance, focal points, rhythms, tension, conflict, and resolved unity. Learning to see beyond the surface of an image is one of the most important aspects of becoming visually literate, for it alerts us to hidden communications, and empowers us to evaluate more astutely a multitude of life and professional situations.

The characteristic ways an artist or visual communicator designs and shapes a visual statement, in which it becomes identifiable as the work of a particular individual, group, region, or period, determines the work's style. The style is also a significant part of its communicated content. As we recognize examples of representation, objective abstraction, and non-representation; or classicism, romanticism, and jazz to post-modernism; we can concurrently create simple visual statements that exemplify these qualities. By making examples in readily available media, such as drawing, photography, collage, or on computers, we gain experiential reinforcement of stylistic, formal, and communication concepts.

The interpretation of the meaning of visual statements is always relevant. How is the subject, information, story, social function, and intent to be interpreted, both within the historical context in which the

work was created, and from the viewpoints both individuals and scholars hold today? Historians, past and present, have interesting and diverse ways of looking at art and visual communication. Iconographic, connoisseurial, structuralist, social, semiotic, and deconstructionist approaches to experiencing visual statements, are all part of a visually literate person's lexicon for interpreting all visual experience. The recognition of hidden intent, persuasion, manipulation, and the ethics of any information embedded in visual expression, relies upon the visual literacy of the individual viewer to discern and evaluate.

We would not consider a person fully literate who could read but not write, so a person who only passively appreciates art and visual communications is not fully literate either. The ability to draw, to take a decent photograph, to arrange objects effectively in space, and increasingly, to use computers and video, are fundamental skills that every educated person should possess. The purpose is not to aspire to make great art or artists, any more than the purpose of teaching writing is to create poets. Through active creation of visual statements, one comes to perceive and know a wealth about the world in which we live, as well as appreciate the visual statements of others. In visual problem solving, forces, structures, relevancies, and implications are discovered, developing paths and methods of thinking that simply cannot be taught intellectually.

Today, when trendy popularity often reigns as a measure of merit and banality can pass for wisdom, all of us need to have the synthetical and interactive tools of visual literacy to evaluate and take responsibility for the visual statements we support and make. Only then can we rediscover the richness of the world with an educated and civilized vision, with sensitivity to the visual statements of others, and to the ecology of which we all are a part.

As one of my literature colleagues is fond of telling his students, "If you don't master the written word, you are destined to be manipulated and mastered by it." By the same token, if we continue to neglect visual literacy in education at all levels, we are at risk of being generously manipulated and mastered by the media of television and advertising. Some say we already are. Thus it is our task to support and nurture creativity through educational courses that are germane to the issues at this time.

Let us begin with ourselves. Each of us, as we got dressed as we are right now, engaged, to some degree of consciousness or lack thereof, in making a visual statement. Each of us individually and together as a group, are visual statements. What we wear, how we carry ourselves, how we look, says a lot about who we are, what we care about and value. What we don't. What we project into the world, what we wish to hide or wish to reveal. Whether we wish to attract one kind of person and not another. Visual literacy is based upon visual responsibility as well as visual response. It has a multitude of rewards which I shall now address.

The Rewards of Visual Literacy for an Artist

My work in visual literacy would never have been possible without something I can only call my own personal and passionate love for the world of visible and visual experience. Early in my career I chose several challenges:

- To carry on the tradition of the nude in Western art.
- To do so with a uniquely personal response that is informed by both tradition and awareness of developing trends, but shackled by neither.
- To depict the essence of our humanness, of our consciousness.

- To keep drawing and painting, realism and abstraction, on equal levels of importance.

This combination of visual experience with verbal expression of that experience inspired me to launch DEEP SEE, a visual literacy consultancy under which auspices I give lectures, workshops, jury exhibits, etc.

Another reward has been participation in a demonstration affordable artist housing project. In addition to being an artist to qualify, however, I also had to finance a down payment and prove that I could garner a stable income to pay off a 30-year mortgage. Having just finished writing my second book, "Making Art Safely" (Spandorfer, Curtiss, & Snyder, 1993), I hung out my shingle as a wordsmith and am currently working at Philadelphia's largest architectural firm as a writer. (To my delight, there are a number of artists who also must earn their living other than through their personal work.) Thus qualifying financially, we artists purchased an abandoned factory building, gutted it and built 18 combined studio and living spaces. Visual literacy served me well as I designed my own space, hired workers to build a loft, install lighting, industrial carpeting, and to paint the ceiling and walls. Having moved into it in August 1992, I am proud to say that I have the home and studio of my dreams, one where I can paint all day by natural light.

In my painting now I am in a period of experimentation including a forthcoming exhibit in which I shall focus on the architecture of Prague; quite different from the elegant architecture of the human figure.

Whatever the subject, in my painting I move on several levels simultaneously. I celebrate the elements: line as melody, color as flavoring; shading and value for mystery and illumination. While I instinctively employ the Bauhaus design principles with which I was educated, due to my work in visual literacy I am more conscious, more verbally aware, of balance, figure/ground relationships, and dynamic forces as energy. Style options and painting techniques threaten to crowd my consciousness with possibilities for painting requires so many choices to be made continually while one works. Some of these choices I make consciously while others, due to the intrinsic spontaneous element of true creation, remain mysterious until after the work is completed. Later I may recognize choices, and question or justify them as an exercise of my ever growing visual literacy.

While developing my work in visual literacy, all these options initially crowded my mind, threatening that I become a calculated rather than spontaneous painter. Nevertheless, I accepted the challenge to extend my verbal vocabulary about visual experience, and I am not sorry. I think that my work is stronger for it, and the recognition I continue to receive may ratify it.

The Rewards of Visual Literacy for All

Now for your Rewards: When you are visually literate, you will be aware and attuned to everything visible around you. This will be affected by the degree to which you choose to be visually aware, for we would be zombies if we proceeded in a constant state of keen visual receptivity.

By the same token, when boredom threatens while waiting for someone or thing, you have the power to become interested in the most trivial thing that lies within your field of vision. You can see it as the remarkable visual phenomenon that it is, watch it dance with all that surrounds it.

As you read a story, a passage of history or literature, you can envision yourself in that place and time, use your visual imagination to bring it alive, make it vivid and memorable instead of an abstract and distant place and time.

As you watch television, you will recognize hype and differentiate it from substance, separate sham from truth.

When you go home or to your work place, you will know how to assess your environment and whether it is designed well for its purposes; whether your room nurtures and relaxes you, or annoys with its discombobulation. You will have ideas about the poetics of space.

When you shop you will assess a product for its positive or negative visual presence. When you dress in the morning, you will see yourself objectively in the mirror, and have a sense of how and what you communicate.

Those who are visual literacy researchers and teachers will educate vision--encourage critical seeing and viewing--with every person and in every way possible.

And finally, you will spend the rest of your lives looking at everything you choose, with a keen and observant eye that is able to differentiate possibilities from actualities, and dare to make the possible actual; to contemplate the ideal and make it real. With visual literacy we are empowered to expedite thinking and critical assessment in all realms of experience.

The Art of Visual Literacy

As for me, all of those are part of my incredibly rich life, and I am dedicated to bringing visual literacy and all it implies to a broader audience. With my work, whatever the subject or medium, I hope to open doors of perception in ways that affirm life and its potential for excellence, integrity, beauty, and enrichment. At the same time, I am aware of realities and atrocities both in the world and within myself. But through all, I continue to explore a synthesis of drawing and painting, to seek a voice that is authentically my own, to paint what it is that I have to say that can be said no other way. As a creative artist, I have the power of creative transformation, and the art of visual literacy suffuses my life with, and in, all that I do; rewarding me in ways that are immeasurable. It is a pleasure to know that my fellow members of the I.V.L.A. are with me in this remarkable realm of inquiry.

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AESTHETICS FOR THE 21ST CENTURY: ANOTHER CHALLENGE FOR EDUCATION

by
Barbara W. Fredette

Nelson Goodman tells us that "art is not a copy of the real world, one of the damn things is enough." But how will we help students to judge or find value in the 'worlds' created through new media? This paper examines aesthetic theories which have guided our value systems for imagery of the past and the present and makes recommendations for an approach to aesthetics which is grounded in and connected to prior image traditions but which takes into account the new image technologies. These new technologies include time arts such as photography, film, video, holography, and computer based systems as well as interactive processes where one or more spectator/creators can be involved both as observer and designer. The search for aesthetic continuity between the older traditions referred to as mark making and the new ones which are recording processes (marking time) is attempted. Implications for education which include consideration of developmentally appropriate school curricula are given in conclusion.

What is Meant by Aesthetics

"Aesthetic derives from the Greek word AISTHETIKA, meaning 'things perceptible through the senses,' with the verb stem aisthe, meaning 'to feel, to apprehend through the senses'" (Abbs, 1991, p. 246).

Aesthetics was first used by a German philosopher in 1744 to refer to the Science of the Beautiful. (Even then an effort was being made to connect Science and Art.) The present use of the term *aesthetics* refers to philosophic inquiry into the nature and value of art and its place within a broad cultural context. In a recent article Marcia Eaton (1990) suggests that the question "what is art " is the most important "issue in contemporary aesthetics--especially if this discipline is to contribute practically as well as theoretically to society" (p. 98). She supports her position by telling us that attempts to find answers to this question are important as a way of uncovering the values of our culture.

"In order to become art, artifacts must be treated in special ways" (Eaton, 1990, p. 98). One important thing that people do when they consider something a work of art is that they talk about it.

Eaton (1990) suggests that it is not the content of this talk that is important but it is the goal of the discussion that is the critical aspect. "When artifacts are discussed as works of art, the goal is to bring the viewer or listener to perceive aesthetic features that might have been missed if the viewer or listener had been left on his or her own" (p. 99). As an educational focus in schools, aesthetics is taught to broaden students perspectives on art and to develop critical skills.

Aesthetics Versus Aesthetic Education

A few art educators have been interested in aesthetic education since the 60's but when the Getty supported effort called Discipline Based Art Education became the "village dance," teaching Aesthetics as one of the four *disciplines* became a concern of many art educators. There is a difference between aesthetics used as a noun, referring to philosophical inquiry in the arts and aesthetic used as an adjective defining education as in aesthetic education. The Getty approach suggests that the content for aesthetics as a discipline comes from the concerns of

aestheticians which include concepts, theories, and issues in the Arts. Aesthetic education as defined by Madeja (1977) is in "its simplest form learning how to perceive, judge and value aesthetically what we come to know through our senses." This earlier educational multiarts approach was interdisciplinary in the sense that all of the arts were addressed through the study of their essential elements and organizational principles with the expectation that these basic learnings could be *connected* with other areas of the school curriculum. In comparison the Getty promoted discipline based art education seems to believe in and promotes the integrity of the separate arts while acknowledging that the four disciplines are essential to education in each of them.

I see a relationship, a continuity between the two approaches (aesthetics and aesthetic education) rather than a distinct difference which requires an either/or selection. Aesthetic education is a broad view in which aesthetic concern may be applied to a wide range of phenomena as a way of gaining familiarity with the specific focus. For example the basic elements of time, space, light, and movement may be explored through a wide range of perceptual activities. Aesthetics tends to be limited to a content focus on works of art.

In 1982 Kern assured us that the purpose of aesthetic education was to help students to understand and to cope with aesthetic experience as a natural, normal component of all human experience. Aesthetic experience is different from other experiences in that it is valued intrinsically. It is valued for itself rather than for some extrinsic end. There can be an aesthetic dimension to all experience, in other words many phenomena can be experienced from an aesthetic point of view. Aesthetic response is, in effect, a learned filter which gives a particular flavor to perceptual experience.

Aesthetic Experience Defined

Aesthetic experience can be described (after the fact), but what makes an experience aesthetic (before the fact) is not easy to answer. Kern (1982) suggested that when all the qualities of an object or an event achieved an harmonious whole, an ideal state of harmony, we may achieve an aesthetic experience. Beardsley (1982) provides five criteria that may characterize an aesthetic or art experience:

Criteria of Aesthetic Experience

1. Object directedness.
2. Felt freedom.
3. Detached affect.
4. Active discovery.
5. Wholeness. (pp. 299-289)

Although Beardsley (1982) suggests that only the first of these criteria--object directness--is a necessary characteristic taken as a whole these attempts to identify the nature of aesthetic experience enhance and expand our reflections on what is involved in responding to works of art.

A parallel aspect must also be considered, that is, what makes a negative aesthetic experience. Kern (1982) and others have suggested that aesthetic experiences (or the phenomena to which they refer) could be placed on a continuum which would range from aesthetic (high in aesthetic potential) through anaesthetic (mundane) to unaesthetic (intense negative experience). Where something would be placed on this continuum is dependent on how its aesthetic qualities are experienced. How a person experiences the aesthetic qualities of something is dependent on two things: their aesthetic preferences and their capacity for aesthetic experience. Many persons believe that their capacity is sufficient as it is referenced through their preference: "I know what I like."

Aesthetic Judgement Versus Personal Preference

I have developed an inquiry process

for my non art trained university students which I believe helps reveal to them the difference between personal preference and aesthetic judgement. In this activity I show three objects to the students and ask them to examine them closely and then to answer a set of questions. The same three questions are asked about each object. The objects are: a mathematical formula, a copy of a Greek poem (in Greek), and a reproduction of a Cubist portrait by Picasso. The questions are:

1. What is it? (describe briefly).
2. Do you like it? Dislike it? Why?
3. Is it good? Not good? Why?

No one has trouble recognizing "what" each thing is and describing it, some with more specificity in terms of its perceived form. As expected the next two questions, especially for the formula and the Greek poem, pose a problem. Some, women especially, say they do not like the formula (as categorical dislike). They may sometimes say that, as a consequence of their dislike for math, the formula is not good. More often they recognize that without knowing what it means they cannot evaluate it (say that it is good or bad). The same is true of the Greek poem. Some say they like it because they like poetry but them admit that they cannot judge it without being able to *read* it. The Picasso is, for many of them, another matter. Unfortunately many who dislike the distortions of the cubist portrait say that it is a "bad picture." Others say that they like Modern Art and therefore it is "good." The students are asked to reflect upon this process and recognize that the two questions ask about different things. We assure them that they are entitled to personal preference (to like or dislike specific works of art) but that this is not a sufficient basis for judging its aesthetic worth. Their capacity for reading the aesthetic qualities of art must be educated just as the aesthetics of Greek poetry before they can judge the worth of the Greek poem. This is an important lesson.

While many phenomena can provide aesthetic experience, only works of art, art objects and events, are created primarily for that purpose. Although some may disagree with identifying it as the primary function certainly a major function of a work of art is to provide opportunity for intense aesthetic experience. Works of art exist for aesthetic reasons and the examination of these reasons or purposes are encountered through the study of aesthetics. It may be useful to look at the place of aesthetics in the four disciplines that encompass art education. (Much about the educational importance of each of these components of art education can be found in the many publications of The Getty Center of Education in the Arts.) The four disciplines are:

Art Production

Creation and Performance

Art History

Cultural and Historical Context

Art Criticism

Perception and Analysis

Aesthetics

Nature and Value of the Arts

Art criticism and aesthetics may be seen as very similar efforts in treating works of art as educational material. Criticism focuses on specific works of art in a more in-depth manner. Aesthetics also uses specific works of art but uses them as a way of getting at larger ideas about art. Knowledge acquired through art criticism and art history become the content for aesthetic inquiry.

I have developed a format for art criticism which is a variation of Feldman's (1973) Critical Performance. I call it a systematic approach to "reading" pictures. The sequentially addressed components for it are these:

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First Impression:

DESCRIPTION

ANALYSIS OF FORM

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CREATIVE INTERPRETATION

Gather information about the work

CRITICAL INTERPRETATION

Summarizing statement

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(Fredette, 1986).

This exercise has proved to be successful in helping non art trained students uncover aesthetic meanings in works of art through their own perceptual efforts. These meanings may then be applied to aesthetic inquiry about the nature or value of art. In other words coming to know a specific work in depth, pursuing the multiple dimensions of meaning within it through an art criticism approach, provides a resource of specific information that can be examined through broad aesthetic inquiry. It is also important to recognize that through this activity of response to a work of art the students are also practicing important response skills. These skills included:

1. The ability to describe aesthetic qualities (discrimination).

2. The ability to explain aesthetic meanings (interpretation).

Questions which sometime arise at this point are: What are aesthetic qualities and furthermore, what is the basis of aesthetic meanings? Although both of these are complex matters I will attempt to clarify them in a succinct manner.

Aesthetic Qualities

Sensory Qualities

Early work in aesthetic education (Kern, 1982; Madeja, 1977) identified these as the traditional design elements of the visual arts (color, line, shape, texture) with the inclusion of sound, space, and motion. Also included were the traditional principles of design called Formal Qualities. These included: rhythm, balance, tension, proportion, harmony, unity, and variety. Degge (1985), in a "Model for Visual Aesthetic Inquiry in Television" identified "Design Operants" which appear to satisfy the same notion of visual attributes or grammatical initiates as the sensory and formal aesthetic qualities listed above. Design operants, which she suggests are the "designing tools of the medium" (p. 87), include grammatical, formalistic, and formulaic clusters of variables which provide a focus for aesthetic inquiry into television imagery. Degge's work is included to show that although specific qualities may change in relation to a particular medium the concept of aesthetic qualities as a basis for description and analysis remains.

Representational Qualities

The variety of meanings accessible through the presented form are another set of aesthetic qualities. In reference to the more traditional two and three-dimensional arts of painting, sculpture, and photography these have been identified as representations of: internal/external images, signs, symbols, feelings, abstract concepts, metaphors. These attributes of representation may suffice for "still" arts or "timed marks" but contemporary imagery such as film, television, and a variety of computerized forms require attention to the aesthetic qualities of the unique perceptual experience of the new imager. In her examination of the aesthetic qualities of television imagery Degge (1985) refers to Berleant whom she writes "argues that (in television imagery) there are distinguishable kinds of aesthetic facts, among them 'experiential facts.' These. . . are made up of statements by artists and qualified perceivers alike 'that presume to describe the characteristics of aesthetic experience itself.'" One experiential category is given as "immediacy" and "ubiquity." Immediacy, however, may be complicated by "issues of reality." What

is real? And to whom is it reality? Degge points out that different versions of reality exist for different viewers. She quotes Tarroni who writes that "a televised event passes through a number of filters (technical and human) which leave it irremediably mutilated and distorted" (p. 92). To what extent does this make the television imagery anaesthetic or unaesthetic? Other aspects of reality are "authenticity" and "time." Each of these representational aspects provide options for varied aesthetic intention.

In summary, aesthetic qualities are those aspects of any given phenomena which are perceptible directly or through interpretation. In this sense aesthetic qualities are features of specific works of art. But aesthetic inquiry must go beyond specific works. In order to answer the BIG questions asked in aesthetic inquiry it is necessary to consider aesthetic theories.

Aesthetic Theories

For many people aesthetic theory is synonymous with philosophy of art, referring to abstract notions of the nature and value or purpose of art. Western theories or philosophies of art tend to fall into four major categories or types of aesthetic tradition (Anderson, 1990). These four approaches are useful to consider because they implicitly fund notions of the meaning of art even for those unfamiliar with them as specific theories.

Art as Imitation: Mimetic Theories of Art

The purpose of the work of art is to represent or *imitate* something in the real world as it generally appears or in some idealized form (better than life). These theories can be traced back to ancient Greece but seem to prevail even today. Heroically proportioned Roman statues, still-life paintings that "fool the eye," and photorealism are exemplars of this theory (Lankford, 1992, p. 8). In popular art, movies which tell it as it is or television programs which portray working class families (even though stereotypical) follow a mimetic charter (Anderson, 1990). People who question the artistic value of the distortions of Picasso or Van Gogh are persons who implicitly adhere to an aesthetic criterion of mimesis. According to this theory "artworks may be judged on their 'correctness, completeness, and convincingness'" (Lankford, 1992, p. 8).

Art as Teacher: Instrumental Theories

The purpose of the work of art is to provide a guide for life, to have beneficial effects on people. This pragmatic theory of art "emphasizes the use of art as an instrument for furthering moral, religious, social or political points of view. . .using this theory, artworks may be judged by their effectiveness in influencing the thoughts and actions of individuals in society" (Lankford, 1992, p. 8). But if art can inspire it can also corrupt. Some people fear art as a result of this theoretical position which leads to censorship. Although there is no way to establish the extent of specific effect it is apparent to many that particular popular art forms serve as establishment propaganda (Anderson, 1990).

Feldman (1973) tells us that:

> . . . instrumentalists do not believe aesthetic values exist independently, that satisfactions or meanings in art can be experienced apart from their involvement in some larger purpose. They would argue that Michelangelo's **Pieta** is a great work not only because it represents realistically a central event in Christianity but also because it supports crucially important ideas about grief and maternal love. (p. 462)

Instrumentalism "emphasizes the legitimacy of art related to the dominant concerns of life and thus acts as corrective to the artistic tendency to become excessively involved with purely technical problems" (Feldman, 1973, p. 465).

Art as Feeling: Expressive Theories

Based on these theories the purpose of the work of art is to reveal the inner psychological experience or feelings of the individual. It is well known that the arts can provoke powerful feelings (Anderson, 1990). Lankford (1992) revealed three versions of this theory which exemplify "different relationships between the emotional life of an artist, the evocative power of an artwork, and the responsive feelings of an audience" (p. 8). One view is that the artist undergoes an extreme emotion and *transmits* it to the viewers of his artwork. A second interpretation suggests that the artists feelings/emotions become clearer as the artist works and these clarified feelings are exemplified in the art which in turn evokes empathy on the part of the viewer. A third view is that the feelings expressed in the art are there as a result of a deliberate conscious production effort by the artist and are recognized by the viewer through the same cognitive realm. Under the aegis of this theory artworks are judged by the vividness of their emotional substance.

Feldman (1973) acknowledges that all art communicate feelings to some extent but to meet this challenge of common factor expressionism "offers us the idea of intensity of experience in the presence of art. The best work arouses the most vivid feelings--feelings stronger than those we would experience in everyday life" (p. 459).

Art as Form: Formal Theories

This may be the most compelling theory of our century. "Formalism emphasizes the composition or structural arrangements of works of art" (Lankford, 1992, p. 9). The form of the artwork is the essential property to be considered. The idea of *significant form* is manifest. Lankford (1992) relates that "critic and aesthetician Clive Bell, in seeking some property common and unique to artworks, concluded that the unifying property was 'Significant Form': a special combination of lines, colors, shapes, and their interdependent relationships which, when perceived, stirred a particular kind of emotion-aesthetic emotion" (p. 9). Anderson (1990) suggests that this is where the notion of skill comes in to consideration in art. Art's formal qualities are the result of masterful manipulation of techniques by artists. The word art refers to the highest level of skill.

Feldman (1973) wrote:

> If we penetrate to the heart of formalism, we should find the wish that works of art depend for their effectiveness solely on the principle of unity in variety, with that unity achieved through the non-symbolic, non-cognitive properties of materials. (p. 457)

He goes on to tell us that "if pressed, the formalist might say that an organization is best when it embodies the ideal structural possibilities of the visual elements present in the work" (p. 457). He suggests that the formalist shares with the Platonist the notion that there is an "ideal or perfect embodiment of all things, and that art, when it is successful, reveals, represents, or communicates that ideal."

Current writers have added to this list of theories. Carmen Armstrong (1990) has developed a teaching resource for aesthetics in which generalizations based on theoretical positions are used as the basis for questions suited to different educational levels which she calls "vertical sequencing" To Art as Imitation, as Expression, and as Formal Organization she adds Art as a Social Institution and Art as No Theory or a Combination of Theories.

These theories of art, ideas about the purposes and products of aesthetic endeavor are important to anyone who has an interest in aesthetics. Weitz (1991) told us not to take the theories literally but instead to see each of them as emphasizing some aspect of art that adds an important dimension of meaning. Single works of art may have multiple meanings, the

Krietlers referred to this as multi-leveledness, Goodman calls it density (Fredette, 1986). Each theory or category of theories may provide a different perspective on a work which enriches an interpretation of it. Weitz (1987) suggests that:

> What is central and must be articulated in all the theories are their debates over the reasons for excellence in art. . . the whole of which converges on the perennial problem of what makes a work of art good. To understand the role of aesthetic theory is not to conceive it as definition, logically doomed to failure, but to read it as summaries of seriously made recommendations to attend in certain ways to certain features of art. (p. 153)

This effort may not be limited to traditional forms of art but is applicable as well to the artistic forms created by new media.

Aesthetics for the Future

When I initially identified the problem for this paper my intention was to review aesthetics ideas and issues related to the imagery of traditional art forms and based on these suggestions for a new aesthetic to be used as a basis for assessing the nature and value of the imagery found in new technology. After an extensive review of the literature (which merely touched the surface of a surfeit of resources on this matter) I have come to the conclusion that it is not a new aesthetic which is needed. No, what is needed is a systematic effort to adapt the analytic criticism format to the attributes of the new forms of imagery. Engaging in this analytic process would in turn provide the groundwork for the synthetic effort of aesthetic inquiry.

The processes of analysis such as those encountered through the systematic approach to reading pictures may remain the same. What needs to change, to be brought up to date, is the list of aesthetic qualities or attributes which must be apprehended in order to develop an educated aesthetic stance toward the new forms of imagery. These attributes, or design operants to use Degge's (1985) term, should satisfy the two categories of what it is (the directly perceptible qualities) and what it means (the interpretive-representational, symbolic or metaphoric content aspects). Technical aspects should be included in the first category and contextual, sociological aspects in the second. In order to use these qualities or attributes as a basis for aesthetic education teachers will need to have several kinds of knowledge about them.

Reimer (1992) identifies and describes four types of aesthetic knowledge or cognition. Because of the implicit emphasis on knowledge as fact or knowing about something it is important to consider the other types or ways of knowing a particular object or form which may be addressed aesthetically. Besides knowing about or knowing that, in other words having the *facts* about something it is also important to know of (or within), to know how, and to know why. Knowing of or within includes understanding the role of form, the role of content and function, and the role of feeling encountered through an artwork. Reimer (1992) suggests that knowing how is artistic cognition and it includes how to imagine, craftsmanship, how to be sensitive, and how to be authentic. It is obvious that these types of knowledge may come about as a result of production or creation of an artwork. Personal creative efforts contribute an important dimension to aesthetic response to the aesthetic work of others. Although it may be called to question there is some generalizability of the abstract notion of creating which may reach across technologies. Certainly the craftsmanship involved in 2-D painting is different from that involved in creating a hologram but the concept of craftsmanship engaged in the process of creation may bridge the two efforts. The last type, knowing why, may represent the highest level of knowledge as synthesis. Knowing why about an art form includes all of the other dimensions

of knowledge. Acquiring all of these dimensions of knowledge may appear to be a formidable task of preparation but they are the necessary groundwork for engaging in aesthetic inquiry. This approach also acknowledges the constructivist notion of psychology which is currently in favor--individuals must construct their own knowledge. It cannot be given to them or *poured in*. This review of the four dimensions or aesthetic knowledge may be seen as a structure for the construction of aesthetic knowledge.

Evolution of Imagery Technologies

What new forms of imagery for aesthetic contemplation will require this construction of knowledge? What new directions for learning through art need to be considered? To answer this question Loveless (1992) writes about the evolution of media technologies and identifies "their changing effects on consciousness and their parallel role in redefining literacy (p. 115). He suggests that children of the future will need to be literate with both data in motion and images in motion. The language of the motion of images found in photo, film, video, and satellite communications is the basis of the latter literacy.

Loveless (1992) reminds us that McLuhan told us, "the artist's obsession with the eye as we have known it throughout earlier traditions in the arts was never the same for at that time a new paradigm was created" (p. 117). Loveless reviews the visual arts traditions which he says have always been concerned with creating images as an obsession with the eye using whatever technology was available.

The first tradition, painting, was an effort to produce an original form which represented an illusion of what was real. Sculpture, he suggests, is the second major tradition based on imaginative uses of three-dimensional space. Each of these forms of imagery changed as new tools and technologies became available bringing new styles and traditions. The third major tradition, photography, came about through the "invention of optics and the isolation of chemicals" (Loveless, 1992, p. 117). It changed the way the world could be seen by providing access to new ways of seeing such as exact seeing (portrayal of a moment in time), rapid seeing (through a succession of shots), slow seeing (time exposures), and simultaneous seeing (through images superimposed upon each other). The generation of successive images in time eventually became the tradition of film and video.

Holography is offered as an introduction to the fourth tradition (Loveless, 1992). It is identified as a medium which brings together art and sculpture.

> It creates a lenseless photography that combines illusion and reality, the aesthetic with the mathematical. . . since each part of the hologram is equal to the whole, we have a 3-dimensional concept of lateral displacement. This introduces a new fantasy of the fourth dimension. Out of this tradition arises the laser and other light-generating forms as well as new technologies for synthesizing images. It is at this point in the history of image making that the computer becomes accessible to the artists. (p.118)

Image making through electronic media must take its place as the fourth tradition in art and as such will need to be addressed through aesthetic inquiry. Questions about the aesthetics of new media bring the concept of technology into play. Technological or media generated issues may be an appropriate focus for aesthetic inquiry. The artists use of new materials or tools may generate discussion about the legitimacy of works of art. What makes an object or event produced through new media art, or non-art?

I suggest that a source for the answer of this question may be found in the concept of children's development in

graphic expression. When a child first holds a drawing tool and makes marks they are exploring what is for them a new medium. The first marks they make are scribbles. Scribbles are records of the actions of exploration of the medium. Children enjoy the power of bringing into existence something that wasn't there before--their marks. I offer the notion that all explorations of a new medium by anyone are in effect scribbles. This is not a negative judgment, it is a way of looking at the possible evolution of skill with a medium which may (or may not) result in achieving the level of *art*. This preliminary effort is a kind of pentimento effort, the practice of skills which must precede future efforts. These efforts when directed toward the goal of art must represent the consciously directed intention of the *artist*. While some *happy accidents* may occur at preliminary stages in the exploration of a new medium the creation of *art* requires a consistent repeatable level of skill which knowingly utilizes aesthetic qualities and attributes integral to the specific medium. This is the artistic cognition that was referred to earlier. It is the aesthetic effort required to make new worlds through new media. Worlds that not only give us new things to see but also new ways to see them. Artists have created a variety of different worlds for us to see and with the newer media more and more are possible.

Educational Issues in Aesthetics

Aesthetics as Philosophic Inquiry

Crawford (1991) assists us in understanding aesthetics as philosophic inquiry. He suggests that this is not to make philosophical aestheticians of students but instead to broaden perspectives and help them to develop critical skills. Philosophy, he writes, "is not simply reflection but **critical reflection**, the assessment of chains of reasoning. . . in the attempt to gain insight into our beliefs and values. . . . Philosophical inquiry, being both reflective and critical, always begins by taking one step back from the phenomena it seeks to understand" (p. 19). He makes the connection to aesthetics by telling us that: "Aesthetics is that branch of philosophical activities which involves the critical reflection on our experience and evaluation of art" (p. 20). Many issues may be addressed in Aesthetics. A primary concern is with "aesthetic values and our standards for the interpretation and criticism of particular works of art. Another major focus concentrates on the many ways in which artworks can come to have significance or meaning" (p. 20). In summary Crawford (1991), writes:

> Philosophical aesthetics is the critical reflection on our experience of art, whether from the standpoint of creators, appreciators, or critics. It aims at understanding the components of these experiences and the bases of the values we find there, as well as at gaining insight into how these values integrated, or sometimes conflict, with other values (such as those in the moral, economic, political, and religious realms). (p. 231)

Aesthetics for Young Students

Smith (Levi/Smith, 1991) suggests that aesthetic learning in the schools is a long journey. The purpose of this journey is the cultivation of percipience which is Smith's term for a well developed sense or art. He devised a sequential pattern for the development of percipience which begins with familiarization, exposure, and perceptual training in Phases I and II which encompass kindergarten through the sixth grade. He proposes that the production of art would be the basis for this goal. Phase III for grades seven through nine is the time to develop historical awareness and Phases IV and V (grades 10-12) is the time for the appreciation of exemplars and critical analysis. In some ways this appears to short change both children and aesthetics as an educational focus. While children cannot be expected to engage in inquiry into the nature or value of art without an adequate vocabulary or personal experience with art they should be

introduced to talking about art as early as possible so that it becomes a familiar and necessary way to think about art. Eventually this talk will become critical discourse.

Hagaman (1992) tells us ". . .the elementary art classroom is as much a place for talk about art as it is for making art. Such talk need not be theory-driven, alien, or dull, but must begin with children's own experiences and their craving for meaning" (p. 106). The NAEA (1992) in "Elementary Art Programs: A Guide for Administrators" includes Aesthetic Valuing as the fourth component of a curriculum outline. The goal is "to develop a base for making informed aesthetic judgements" and the objectives are:

1. Make informed responses to works of art, nature, and other objects within the total environment by using objective criteria for analysis, interpretation, and judgements.

2. Derive meaning and value from experiences by making and justifying judgements about aesthetic qualities in works of art and other objects within the total environment.

3. Use analysis interpretation, and judgement about visual relationships based on learned aesthetic values (p. 6).

The content/skills listed are:

- Analyze Design Elements
- Recognize Use of Design Elements
- Recognize Art Media and Processes
- Recognize Artistic Styles
- Describe Aesthetic Characteristics
- Discriminate Artistic Styles
- Analyze Aesthetic Similarities and Differences
- Recognize Artistic Characteristics
- Recognize Aesthetic Characteristics. (p. 6)

Appropriate activities for grades K-2 and 3-5 are given with each of the identified content/skills except "describe aesthetic characteristics" which is not expected of grades K-2.

Conclusion

Aesthetic ways of knowing must become part of the basic education of all students. What is learned is dependent on the ways in which it is taught. Students at all levels should be given opportunities to engage in talk about art that reveals not only the ideas encoded in the art but also important things about themselves as human beings. The art which engages this talk should represent a wide range of imagery including that produced with electronic media.

Technology is both science and art. I have attempted to show that aesthetic knowledge is important, perhaps as important as scientific knowledge in understanding the imagery of our culture. Science and art are not antithetical but in fact from the beginning have been conjoined. The Greek goddess Techne was the patron Goddess of both practical knowledges and of art. The Greek word *tikein* (to create) comes from her name (Shlain, 1991.)

"The meaning of aesthetics, like the meaning of 'love,' depends on who says it and where" (Anderson, 1990, p. 33).

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USING HYPERMEDIA TO TURN UNIVERSITY TEACHING INSIDE OUT

by
W. Lambert Gardiner

Five Processes of Change

Innovations in computer technology, innovations in telecommunications technology, their convergence into informatics, and their penetration into society has resulted in a paradigmatic shift from an industrial society, based on energy, to a post-industrial society, based on information (see Figure 1). The revolution is over. Focus now shifts from "What's happening?" to "So what?" We now consider the implications of this shift for our various institutions. The major implication for my discipline of communication studies is that it introduces a fourth generation of media.

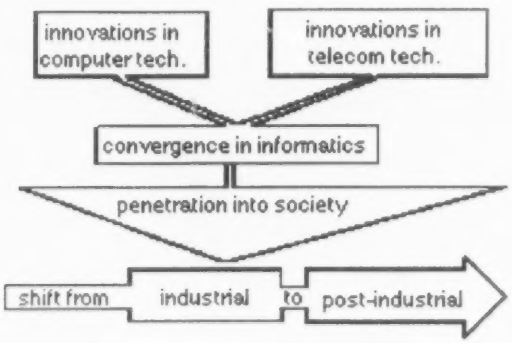

Figure 1 Five Processes of Change

Four Generations of Media

Carl Sagan (1977) classifies tools as extragenetic (that is, outside the genetic code but inside the body) or extrasomatic (that is, outside the body). Any medium involves use of tools for the storage and the transmission of information. Those two distinctions yield a two-by-two matrix, which can serve as a useful taxonomy of media (see Figure 2).

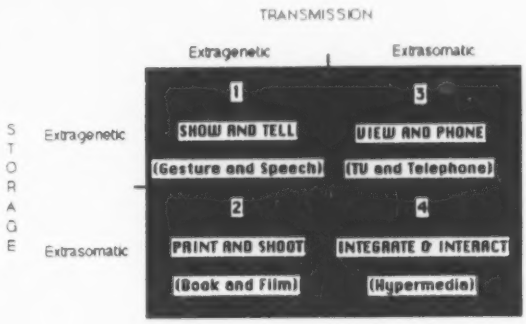

Figure 2 Four Generations of Media

In the first generation (speech), storage and transmission of information are both extragenetic; in the second (print), storage is extrasomatic; in the third (video), transmission is extrasomatic; and in this emerging fourth generation (hypermedia)--which completes the taxonomy--both storage and transmission are extrasomatic. Information is stored electronically in diskettes (floppy, hard, video, CD-ROM, etc.), and transmitted by the informatics infrastructure of a network of computer nodes linked by telecommunications. Whereas the second generation assists in the creation of a conceptual map of the objective world (verbo-literacy), and the third generation in the creation of a perceptual map (visual literacy), this fourth generation enables us to integrate those maps (verbo-visual literacy).

Three Interfaces of Adam

Since the shift from an industrial to a post-industrial society is a structural rather than a sectorial shift, it is necessary to have a broad model to understand it. That is, a model which describes the whole society rather than simply some sector of it. The Three Interfaces of Adam is an attempt at such a broad model.

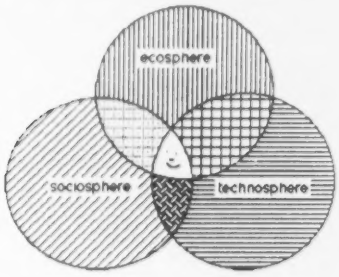

Figure 3
The Three Interfaces of Adam

The person could be considered as the triple overlap of three spheres--ecosphere, sociosphere, and technosphere ([Gardiner, 1987] see Figure 3). It is important that the environment be differentiated into the natural world (ecosphere), social world (sociosphere), and artificial world (technosphere), because, whereas the person is part of all three, the relationship between the person and each of the spheres is different. The person is the most complex system in the ecosphere, an element of the sociosphere, and the source of the technosphere. The study of the person in each of those spheres is therefore different. Person-in-ecosphere is the domain of the natural sciences, person-in-sociosphere is the domain of the social sciences, and person-in-technosphere is the domain of what Herbert Simon (1981) has called "the sciences of the artificial."

Two Hemispheres

Within each person in the center, there is a subjective map of the objective world (see Figure 4). We usually consider media as mediating between people. However, they can also be considered as mediating, within each person, between this subjective map and the objective world. The subjective map could be considered as composed of a perceptual map and a conceptual map, corresponding roughly to the thing and the word in the objective world and to text- and image-based media (see Figure 5). It is a useful metaphor to consider the perceptual map as a function of the right hemisphere and the conceptual map as a function of the left hemisphere.

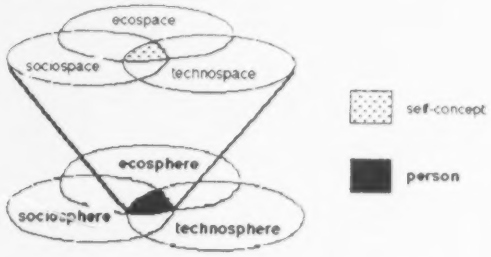

Figure 4 Objective World and Subjective Map

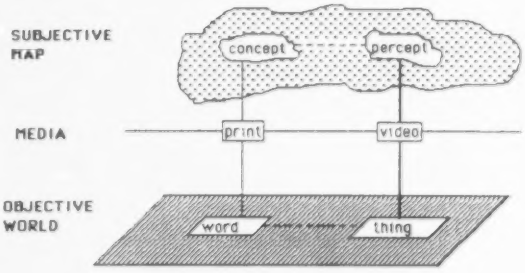

Figure 5
"Media"ting Between Subjective Map and Objective World

Some tasks are best performed by the left hemisphere and some by the right. We academics tend to privilege the left hemisphere. For example, it is obvious that recording directions given over the telephone lends itself best to the perceptual map. This has only become obvious to me, however, within the last year (partly as a result of thinking about those things). For example, look at Figure 6. On the left (for the left hemisphere), you see my attempt to record the directions to the house of my friend Sally written on 22 March, 1990; on the right (for the right

hemisphere), you see my attempt to record the directions again, drawn on 7 July, 1990--just over three months later. (In the interval, I had forgotten how to get there--partly because I had used my left hemisphere inappropriately.) The second strategy was superior--not only because I was able to get there with only one stop to glance at the map but also because I still remember how to get to Sally's place years later--the physical map has been etched in as a mental map. We have to learn to fire on all our cylinders.

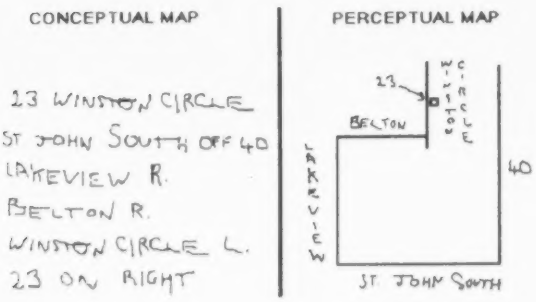

Figure 6
How to Get to Sally's Place

One Corpus Callosum

Within this metaphor, the computer could be considered as the corpus callosum. This captures the two basic characteristics of computer-based media--integration and interactivity. The corpus callosum links the two hemispheres, as the computer integrates text and image, and it may link the cerebral cortex with the rest of the body, as the computer provides interactivity between thought and action.

Now that we have the technology to simulate the entire nervous system, we can seriously consider mapping our subjective maps isomorphically on to the objective world. The structure of hypermedia--a network of interlinked nodes--is isomorphic with the structure of the mind--a network of interlinked concepts--and the structure of the informatics infrastructure--a network of computers interlinked with telecommunications (see Figure 7). It serves then as a positive prosthetic which fits.

A major problem of our post-industrial society is the management of complexity. Our rich information environment enables us to make a subtle subjective map of the objective world. The computer helps us manage this complexity. Just as the telescope brings the too-far near enough to observe and the microscope makes the too-small large enough to observe, so the computer makes the too-complex simple enough to observe.

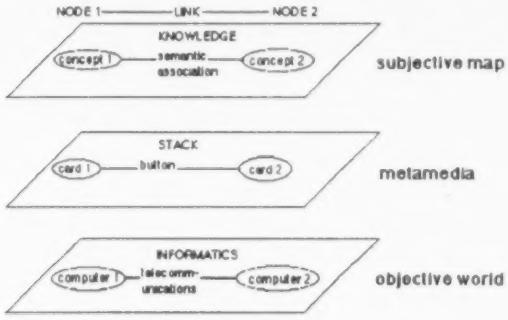

Figure 7
Isomorphism of Hypermedia

To do so, however, we must stop using it as a typewriter. It is necessary to go beyond word-processing (one-dimensional) to idea-processing (two-dimensional) to meta-media (three-dimensional). See Figure 8.

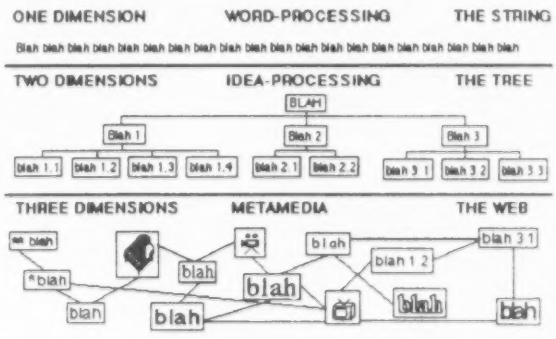

Figure 8
Three Dimensions of Computing

Hypermedia has incredible potential as a tool for teaching in the university, which has confined itself largely to the first two generations of media--talk and chalk. This paper describes the use of hypermedia by the author in his lectures, seminars, and tutorials.

The four communication settings in university are listed in Figure 9. Hypermedia simulates the fourth setting, which is the real-life situation of the student. He/she is dealing with information from many sources (various professors, parents, friends, media, and so on), impinging on a single destination. Let us look, in turn, at the use of hypermedia in each of the three other settings.

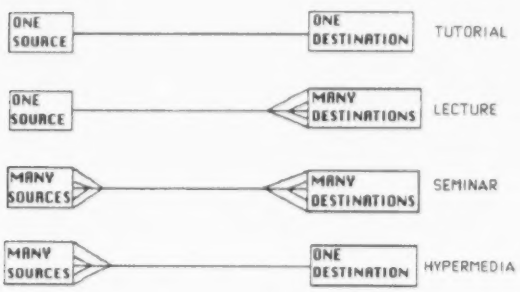

Figure 9 Four Communication Settings in the University

Hypermedia in Lectures

Before each of my classes, the students are given a handout which includes an outline of the presentation, the figures, and the references. This enables them to be scholars rather than secretaries. There is no need to feverishly make messy, inaccurate copies of my material. They are encouraged however to make, rather than take, notes on the content of the lecture.

The cards are projected on a screen using an electronic blackboard attached to the computer. This establishes a common visual space. The advantage of the electronic blackboard over the traditional blackboard, is that the material need not be laboriously and messily written and drawn, then rewritten and redrawn the following year. The advantage over the overhead projector with transparencies is fully appreciated only when animation is used. It is difficult to show 24 transparencies per second.

The handout is a hard copy of a Hypercard stack. A disk containing all the handouts in electronic form is given to any student who requests it. They are encouraged to use this stack as a *starter set* to which they add their own cards and links, and to use the computers in the university lab if they do not have one at home.

Hypermedia in Seminars

Despite those innovations, the setting is still teacher--rather than student--directed. This may be an inevitable feature of the lecture setting. It is still show biz. The innovations simply permit the teacher to put on a better show.

I have transferred a solarium in my electronic cottage into a Smart Room, which is my vision of the seminar room of the future (see Figures 10, 11). It differs from the traditional seminar room largely because it contains Caesar. This is a system for pulling information into the room from other computers over the modem, from CD-ROM discs, from videodiscs, from the hard disk, and so on (see Figure 12).

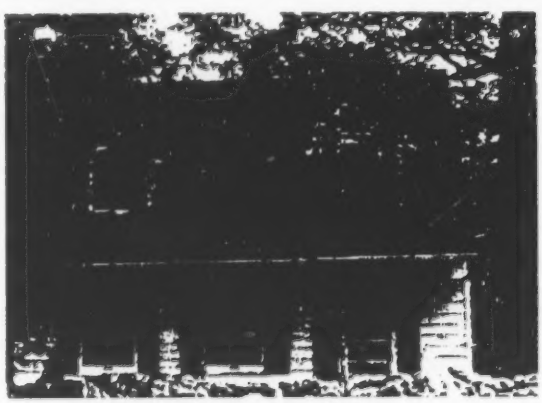

Figure 10 The Electronic Cottage

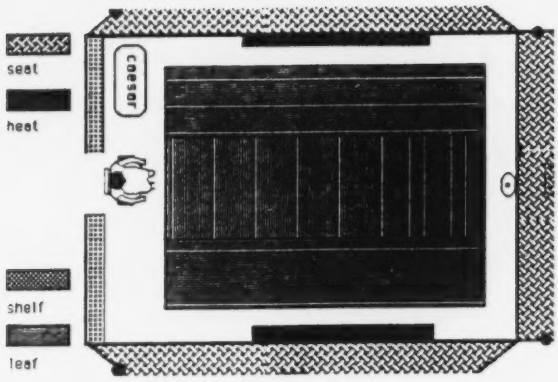

Figure 11 The Smart Room

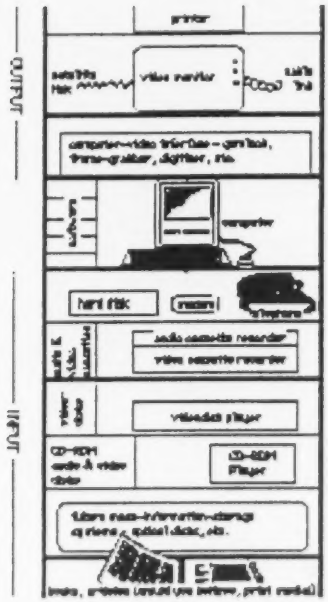

Figure 12 Caesar

Hypermedia in Tutorials

Whereas tutorials are the basis of university education at Oxbridge, they play a minor role in North America. Honors projects and directed studies are very minor (and unrewarded) aspects of teaching. Perhaps, now that we have electronic colleagues to do the outside-in information-providing aspect of teaching, tutorials could play a larger role, since the teacher has more time and energy for the inside out inspiration-creating aspect of teaching. The advantage of the tutorial is that the student chooses the topic, the professor, and directs the project. Unless they learn to do so, they will never become independent scholars. It is not by chance that Oxbridge has produced so many fine scholars.

When a student approaches me about a tutorial, I consult my colleague, Siliclone. This is a satellite brain containing all my favorite sources, notes, quotes, anecdotes ([Gardiner, 1987], see Figure 13). Rather than vaguely muttering the names of some possible sources, I print out the information in my siliclone which is relevant to his/her topic. This synergy between the person and the machine is an attempt to find some optimal orchestration of natural and artificial intelligence.

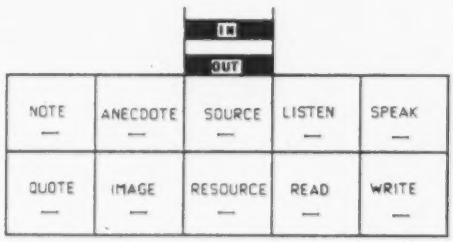

Figure 13 The Siliclone

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ENHANCING LOCAL AND DISTANCE EDUCATION WITH COMPUTER-PRODUCED VISUALS

by
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The increased capability and availability of computers for education has led to questions about the potential applications and impact of this medium on the teaching and learning process. The design of visual images can greatly promote or interfere with learning. Image design needs to consider several variables including, but not limited to, the audience and intended message, along with the medium and technological constraints.

When learners use computers on a local basis, they have opportunities to interact with the program. This interaction enables each learner to control the pace, length of a session, and path through the program (Jonassen, 1988). Distance education offers the ability to reach a larger range of students, but the technology often limits the type of interactive possibilities. Computers can be used to offer online instruction in both live and delayed modes. Audiographics and other types of shareware even can allow multiple users to manipulate the same screen image. But the most common usage of computers in distance education is in the preparation of a visual image that is then sent to the students by videotape, television broadcast, coded transmission, facsimile modem, or in print format by using facsimile or paper distribution systems. As computer-based multimedia products become more standardized, they too have a place in the distance learning scheme.

Ongoing improvements in computer hardware and software have removed some of the former technological barriers and now computers can supplement text with colorful graphics in both static and dynamic modes. Computer-controlled multimedia presentations can display images that are either digitized such as those on CD-ROM, or analog format such as those played from a videodisc. Some equipment even allows a mix of both analog video and digital displays on the same screen.

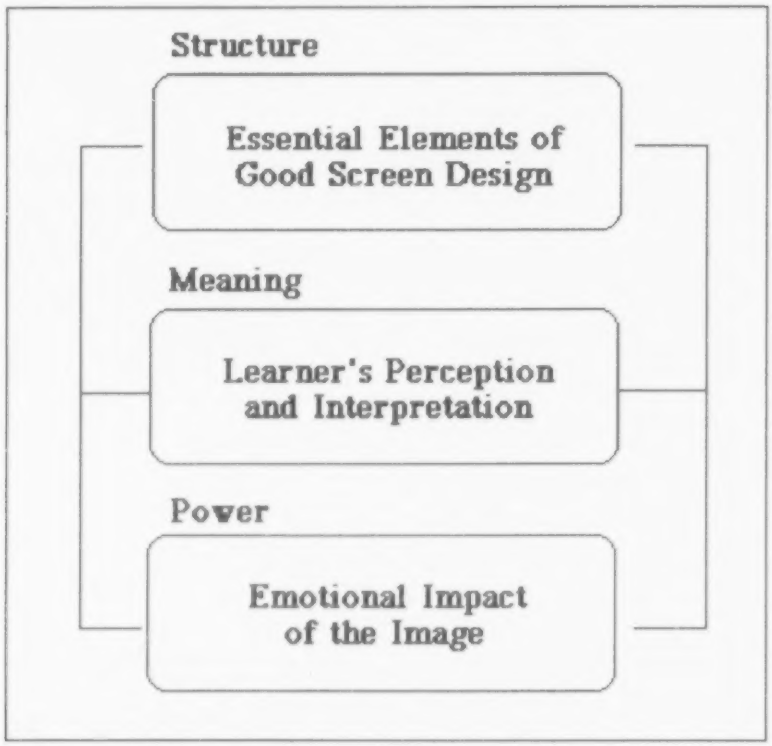
Because computer and television screens contain similarities, there are some design considerations that are common to both media. Presentations that mix images from a computer with images from a videodisc, television camera, or other projected image generally follow the rules of televised video screen design with some special consideration for the computer-based medium. This paper addresses some design considerations for computer-produced visual displays that are intended for either local or distant audiences. It assumes that electronically-produced instructional images require different design considerations than those that are limited to print.

Information display can be organized into three perspectives: the structure of the image, the meaning of the image, and the power of the image (see Figure 1). The structure of the image contains the essential elements of good screen design. These elements can enhance the learner's ability to perceive and interpret the intended message. This leads to the learner's ability to apply meaning within the given context. Finally, images add power to text-based messages; they have the potential to both clarify the message and add emotional impact.

Structure of the Image

The structure of the image first considers the visual as a whole, then its components and the elements of good screen design. In order for the various image components to work together, elements of well-planned screen design

Figure 1. Effective Instructional Images



must weave the components together in an aesthetically pleasing and understandable format. Thus, one must consider both the image and the screen design.

The Image

The image contains a mix of components that can work together or separately to modify the intended message. As you read this section, try to visualize the possible image variations that result from influences such as text, color, graphics, animation, and multimedia.

Text

Since text dominates computer-based instruction (Soulier, 1988), it is important to design text displays that communicate clearly to the reader. With appropriate fonts and spacing, computer screens can work very well for presenting limited amounts of text. Large amounts of text work better in printed form (Soulier, 1988) since they induce eye fatigue (Hathaway, 1984; Mourant, Lakshmanan, & Chantadisai, 1981) and are likely to be forgotten when presented on the screen (Wager & Gagne, 1988).

In addition to the amount of text, its density, along with typographic cueing and the mix of upper-case and lower-case characters can affect legibility (Hartley, 1987; Hathaway, 1984; Morrison, Ross, & O'Dell, 1988; Ross, Morrison, & O'Dell, 1988). Variations in font type, size, and density along with direction and screen placement can add meaning to the text image (see Figures 2 and 3). With the exception of titles, headings, or special effects, the text should contain a mix of upper and lower case letters.

No matter what the screen design, legible text requires an appropriate font that is properly spaced. There is disagreement about the appropriateness of serif or sans serif style fonts. Some

authors claim that fonts with serifs, as opposed to block-style lettering, are a better choice for computer screens (Soulier, 1988). Yet others believe that sans serif fonts with proportional spacing provide a cleaner effect that is easier to read than their seriffed counterparts (Gibson & Mayta, 1992; Kemp & Dayton, 1985). Fonts with small serifs can add interest to the display, while elaborately-seriffed fonts are difficult to read, especially if the image is to be viewed on television or in a large room.

Text legibility also depends upon the point size of the font. The point size of text on a computer screen can range from 12 to over 100 points per inch and remain legible. However one should consider the intended usage when selecting point size. Images that are likely to be projected for large audience reading should not use a point size smaller than 26 (Gibson & Mayta, 1992) and images that are not likely to be projected or broadcast will seldom require an extremely large font. Also consider the user; when designing screens for young children or people with visual impairments, use a larger font.

In addition to style and size of the font, the weight of the typeface, line length, phrasing, and spacing between lines of text affect the legibility of computer screens. The weight of a font can vary from light, narrow, fine lines to heavy, broad, bold lines. A medium to bold weight is very good, depending upon the mix of elements on the screen. Gibson and Mayta (1992) recommend that bold typeface be used throughout all computerized screen images that are intended for broadcast so that the text shows up against the graphics. At the least bold fonts should be used for all titles and headings as well as for particular words that need emphasis. Drop shadows behind the text characters can add legibility if used carefully.

Because computers, monitors, software, and projection systems are becoming more capable, perhaps it is not as critical to adhere precisely to recommendations about font style and weight as it was in the past. An important contributing factor is the availability of good resolution provided by a VGA monitor and a quality projection device. Also, color can be provide visual cues within the text.

Color

Specific educational objectives can be enhanced by using color in visual illustrations (Dwyer, 1978), but while a few colors can cue the learner about the intended message, too many colors can be confusing. Color should assist the user in focusing on the material; it should never be a distraction (Gibson & Mayta, 1992). Accordingly, Hannafin and Peck (1988) suggest using a bright color to cue the learner for new information, while presenting the remainder of the information in standard colors consistent with the rest of the screen. Soulier (1988) recommends checking the program on a monochrome monitor and using a pattern as a backup technique to aid those people who are color blind.

Although this document is printed without color, Figure 4 shows an example of how color can be used to highlight menu choices. In part A, the learner sees that the *Child Development* module has five selections, with *Review* currently highlighted using a border color that matches the background of the *Child Development* box. Part B shows that the learner has single clicked the *Normal Development* topic and that box as well as the boxes of the newly revealed subtopic choices are now bordered in the highlight color. Highlighting the menu selections in this way can be particularly helpful in situations where there are many potential branches.

A few colors with good contrast values will show up well on both color or monochrome displays, but an extreme contrast like stark white on a black background will cause bleeding and illegibility; it is better to use light grey to achieve the desired effect. Also avoid high

Figure 2. Light and Airy Text

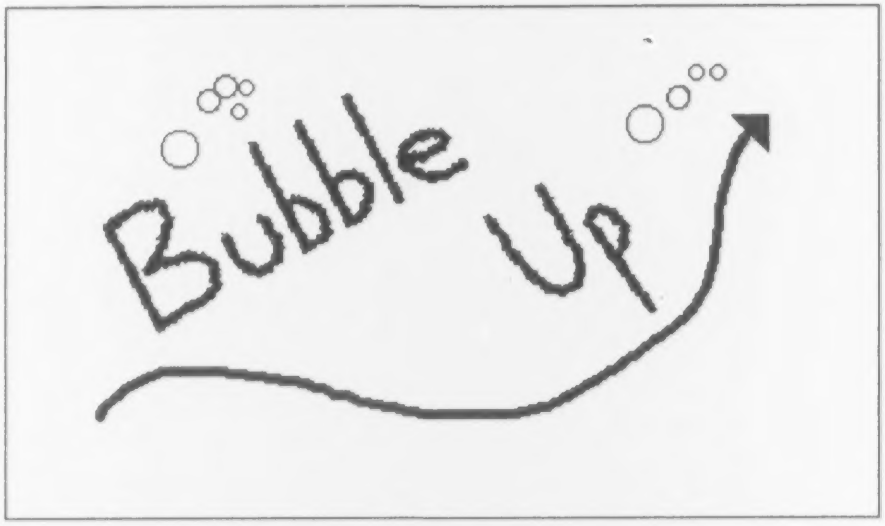


Figure 3. Bold, Forceful Text

values of red and orange because they can bleed into the surrounding colors.

In addition, certain colors that look ideal on an individual computer screen tend to flare or wash out when they are projected to a large screen or transmitted over a distance. To avoid disappointment it is best to experiment with a few color combinations using the equipment that will support the image when it is actually projected. Complementary colors with low saturation would have a good chance of working.

Graphics and Animation

Graphics add interest to the screen by providing visual variety (Kemp & Dayton, 1985) and offer another opportunity to suggest meaning to the learner. Possible graphic treatments range

from simple to complex, from small monochromatic embellishments to dramatic, richly-colored, full-motion video images complete with sound effects.

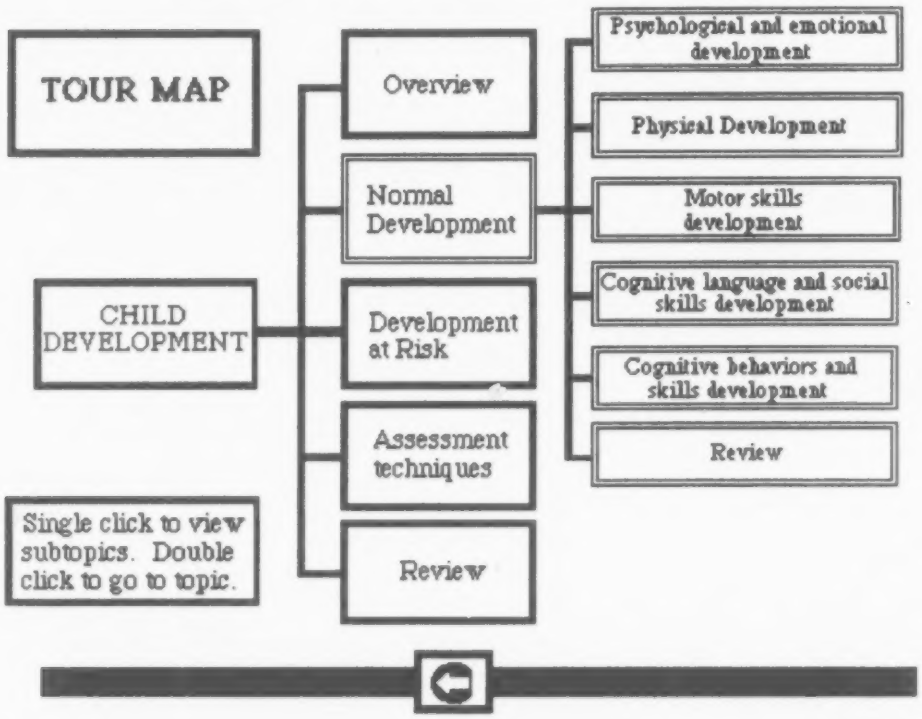
Like verbal metaphors, visual metaphors can help us to understand an unfamiliar concept. Metaphoric graphics (Soulier, 1988) may be used to clarify a meaning within the computerized message, or they can guide the user through the mechanics or functionality of using the software. For example, standard weather symbols might represent part of the content in a lesson about tornadoes while an exit sign icon would symbolize the functionality of the software.

Computer images are frequently transferred to other media such as transparencies, camera-ready art, computer-designed slides, animation, video segments, and so on. One type of graphic application that is regularly produced beyond the original computer screen is the common tabulated data graph. Graphs that represent data need to be clearly designed so the reader can interpret the meaning based upon the legend, scales, symbols, and other provided cues.

Graphs that display data depend upon the reader's thought processing, interpretation, and comprehension; to be effective they must consider the intended visual message carefully. Sophisticated graphic displays that are designed to suggest inferences, generalizations, and evaluative interpretation can help students interpret meaning (Reinking, 1986; Singer & Donlan, 1980). High-level instructional graphics, such as symbolic, schematic, or figurative displays can be effective in teaching, and the visualization of abstract ideas through figurative displays may very well enhance learning (Nygard & Ranganathan, 1983). All graphics do not require the same level of detail and clarity, but even simple, decorative graphics at the pictorial level have their place. Indeed, Boyle (1986) suggests a need for designers to address cognitive processes by developing more materials for graphic thinkers, not just graphic readers.

Figure 4A. Color Highlighted Menu, Part 1

Figure 4B. Color Highlighted Menu, Part 2



To assist with designing computer graphics, Soulier (1988) offers the following guidelines: Keep illustrations appropriate for the audience; use simple line drawings when possible; preload graphics into the program so that they appear quickly on the screen; use standard symbols and symbolic representations; and keep graphics on the same screen in close proximity to the corresponding text message. These few tips can greatly improve the aesthetic appeal of a graphic and promote clarity of the message.

Most development software allows the use of simple animation to illustrate a motion, provide interest, or draw attention to particular areas of the screen (Kemp & Dayton, 1985). Although it is tempting to embellish the graphic, it is important to use animations only when appropriate and keep them short (Soulier, 1988).

Animate only a few graphics that will aid the learner's comprehension of the material by, for example, gaining attention or illustrating a concept. When used sparingly animations can be effective, but they can become irritating, distracting, or disruptive to the thought process if overused or left on too long. Whenever possible, allow the user to interrupt the animation.

Computer-Based Multimedia

Computer-based multimedia includes a wide range of possible delivery options, but is usually characterized by mixing video images with computer images. The possible styles range from single computer screen, to projected computer screen, to 360 degree *theater in the round* displays.

A currently popular instructional practice uses multimedia to support lectures with images from a videodisc or compact disc driven by a computer program. Despite its great potential for providing rich imagery and stimulating

thought, this delivery method often falls short of expectations because of cluttered screens or inappropriate lesson delivery. One of the greatest problems in actual usage is the size of the text; the audience cannot read text from a distance unless it is enlarged. A second common problem is washed out colors in the computer graphics; color selection that does not hold up during projection. The general suggestions for computer screen design found below may be applied to various forms of multimedia displays as well as more traditional computerized images.

Screen Design

Good screen design aids the learner by using visual components to portray the message in a way that provides both clarification of information and visual interpretation. To visually aid the learner, it is necessary to consider the specific elements of good screen design as well as the general screen layout.

Elements of Good Screen Design

Interesting screens are composed of a variety of elements that work well together. Many of these elements are equally important so they are presented here in no particular order. The goal of good screen design is to use the various elements together to compose a simple, consistent design that provides sufficient information while avoiding clutter.

Unlike printed material which can be skimmed at will, the computer screen limits the learner's view of the overall content. Screen designs that are simple, straight forward, and consistent can help lead learners through the material, while complicated designs can lead to frustration. The basic simplicity of frame layout and user options does not restrict the ability to add interest and meaning with a full range of simple and complex graphics.

Certain user options should always be available. For example, status lines at the top or bottom of the screen that contain consistent information help the learner assess progress and maintain some control over the program direction. The reader should control the display rate when possible so that there is adequate time to read the text, interpret the graphics, and consider the meaning of the message.

Menus should be clear, concise, uncluttered, and consistent. Icons within menus can be very helpful if the meaning of the icon is readily apparent. The range of possible choices in some programs can lead to cluttered or excessively layered menus; pull-down menus can be a solution. Highlighting or fading some menu choices will quickly give a visual cue about which items are currently available.

Careful positioning of text on the screen can add to its aesthetic appeal and legibility. Although centering can work for lists, diagrams, or graphic mixes, most text should be left justified and limited to 65 characters per line or 25 characters per line for projected images. Partitioned screens in which text is confined to specific areas, can work very well.

Ross and Morrison (1988) suggest using a hierarchical text display that is vertical and uses indentations similar to an outline. They further recommend a low-density text display with reduced wording and sentences limited to one main idea. It it also important to use care when splitting lines so that phrases remain complete Soulier (1988). Personal preference varies concerning single or double spacing of text, but do provide text breaks where the content allows.

In addition to font size, the text legibility is influenced by contrast with the background. Common considerations for both computer screens and video images suggest cool, neutral background colors like grey or blue instead of bright, very light, or very dark backgrounds. Tasteful use of enhancements such as outlined, inversed, flashing, or drop shadowed text can add to legibility.

Special techniques for changing the screen display, such as zooming, panning, tilting, and wiping onto the screen, can vary the viewer's perspective of the image. For example, a section of the screen can be enlarged to give a close-up view of specific details. Or the image can change from a long shot displayed in a small part of the screen to an extreme close-up showing part of the same image displayed in full screen mode. This technique can give the learner the sense of moving in to take a close look at the image. Imagine, for example, the visual effect of looking at a long shot of a group of trees in a small box on the screen and then changing to a full screen display of a close-up shot of leaf on one of those trees.

When broadcasting computer graphics for distance education, overscan and underscan considerations become important. Overscan fills the screen beyond the edges so that no blank space will show around the edge when the image appears on a television monitor; computer graphics need to be produced in overscan mode so that no blank edges or distracting video signals will show around the edges during transmission (Gibson & Mayta, 1992). Underscan protects a blank area around the screen edge so that images don't get cut off during the transmission process; important information should be placed within a safe area, usually the middle two-thirds of the screen (Kemp, 1980). It is important to pay attention to both overscan and underscan because the desired result is neither an empty pocket around the around the screen nor loss of important information around the edges. One way to handle overscan and underscan variations is to use a border around screen; this fills the screen edge completely while marking the safe area.

Screen Layout

The elements of good screen design work together to build a cohesive screen layout. The computer screen layout should never be visualized as a printed page filled with text, but guidelines similar to those offered for desktop published materials can be helpful. These include balancing text with white space, improving the aesthetics of the page, and positioning graphics as the dominant visual element (Parker, 1987). Designing the display with attention to legibility, the purpose of the particular frame, and consistent protocol, can result in visually interesting computer screens. Avoid cluttering the screen with too many images; provide print copies of complicated images that are important to remember.

Like silence within oral communication, empty spaces can be used to advantage on the computer screen. For example the screen can be used to organize or highlight information, to draw attention to particular parts of the frame. The mix of graphics and text can provide a visual cue; so can boxing and grouping of information. Partitions, borders, standard icons, and consistent placement of common elements will visually aid the reader.

While partitions and borders can draw attention to an area, artistic sense can still flourish. Figure 5 shows a screen layout that protects a bordered area for graphics where the designer has incorporated two borders, one within the other. The image is allowed to overflow the internal border while being contained by the external border.

Generally headings are centered and bold, sometimes even boxed. For long or complicated sequences, subheadings can be used that include numbers or Roman numerals to aid the reader in visually following the general flow of information. As a general rule, information should flow from the top, left part of the screen to the bottom, right part of the screen because that is the way people in our culture read. Figure 6 shows artistic variation that splits a title between the top and the bottom of the screen. Because the information flows from top left to bottom right, this title works. It also provides a subtle hint to the reader about the program content; both the title and the quilts discussed in the

program must be pieced together to make a whole. Variations in standard layout can work if they are with purpose and fit the situation.

Good layout technique depends upon an understanding that not all computer frames are alike. Hannafin and Peck (1988) address transitional, instructional, and question frames. Transitional frames are used to tie together the different parts of the a computerized lesson: they provide an orientation to the beginning of, and various sections within, the program; they serve as bridges between various topics or sections; they provide feedback, directions, and instructions; and periodically, they present a progress report to let the learner gauge success. Instructional frames present basic information to the learner: these frames can alert the student to a need for prerequisite information; provide links between relationships from past and current learning; and provide definitions, examples, and rules. Question or criterion frames solicit input from the student to help individualize the instruction; these frames usually are based upon a true or false, yes or no, multiple choice, completion or short answer, or a constructed response which is considered to be a more open-ended answer.

There are also variations to the general type of frames. For example, sometimes a frame contains both instruction and a question. Copy frames, prompt frames, hint frames, and interlaced frames are some types of variations (Hannafin & Peck, 1988). Copy frames provide information and a question about that information in the same screen. This type of format can be helpful in directing student attention, emphasizing important points, and for assuring a high degree of success for particular students. But because they are so obvious, copy frames are considered very elementary and need to be used sparingly.

Prompt frames direct the learner to supply input; these can be used effectively for questions as well as instructional screens. Hint frames are usually provided after a student has failed to enter an expected response; they offer guidance but do not supply the correct response. Interlaced frames are hybrids which combine various components from the

Figure 5. Partitioned Frame with Double Bordered Graphic

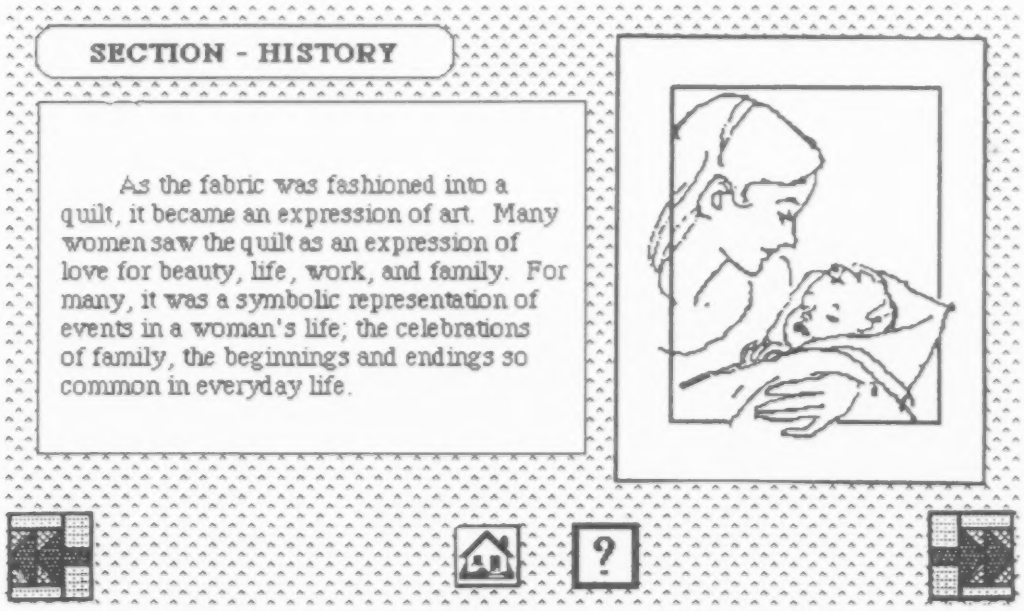
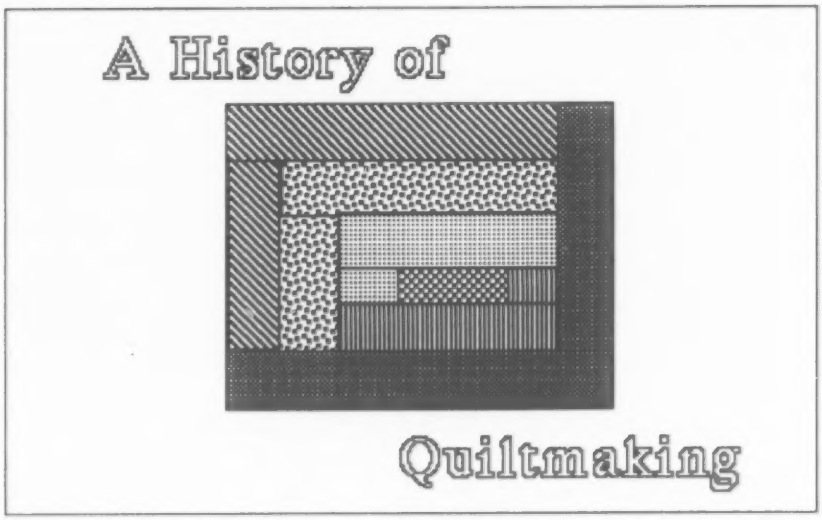

SECTION - HISTORY
As the fabric was fashioned into a quilt, it became an expression of art. Many women saw the quilt as an expression of love for beauty, life, work, and family. For many, it was a symbolic representation of events in a woman's life; the celebrations of family, the beginnings and endings so common in everyday life.
?

Figure 6. Left to Right Title Split:



standard frame types; they might include instruction, question, and feedback all on the same screen. This design can appear cluttered if not presented carefully but it has the advantage of allowing the student to visually examine and compare the question and feedback.

Each type of frame depends upon grouping of information in a way that visually aids the reader. To make optimal use of visual cues, it is helpful to design standard protocol for each type of frame and use it consistently throughout the program. Whatever protocol is chosen will need to comply with the overall program design. Programs that vary the screen location of pertinent information or procedures used to advance throughout the program can be confusing and frustrating (Mackey and Slesnick, 1982). Although standard protocol is necessary (Heines, 1984; Lentz, 1985; Simpson, 1984) designers can provide artistic variation to other parts of the screen to suggest meaning.

Meaning of the Image

Information becomes valuable as it takes on meaning for an individual. Since visuals are meant to aid in the discovery of meaning, it follows that well-designed visuals will help students interpret the meaning. Computer images vary widely in potential design and usage. Images can be static or dynamic, concrete or abstract, and they can change as a result of user interaction with the program. A learner's interpretation of the image can be affected by the text, type of graphic, and layout employed.

Layout must consider the principles of perceptual organization, which include similarity, proximity, continuity, and closure (Bloomer, 1976). These four processes, by which the mind organizes meaning, depend on how physically close the objects are, how similar they are, whether there is a continuous line to guide the eye, and whether the minimal amount of information is present that is necessary to obtain meaning or closure. Comprehension is directly affected by the way the mind organizes meaning from the placement of graphics and text.

Creating Meaningful Data Displays

Since powerful computers and software are now available to many people, the practice of transforming numerical data into visual displays is no

longer limited to trained professionals. It follows that some design guidelines are needed.

Graphs

There is a wide selection of software that produces graphs to tabulate or represent data. These data displays can take the form of circle or pie graphs, bar or chart graphs, line graphs, histograms, and scatterplots, among others. The ease of creation does not always result in good, meaningful graphics. It is important to follow some common sense approaches to graphical data display, whether the information is to be used on or off the screen, locally, or at a distance.

It is tempting to use various software features to make elaborate and colorful graphs, but in reality simple is better when displaying data (Tufte, 1983). To help learners interpret the meaning of graphs, use only those dimensions and colors that are necessary to convey the message; three dimensional graphs should only be used when the third dimension represents a third aspect of the data interpretation, and color should only be used for contrast as an interpretational aid. To help illustrate the point, two poor graphs and a better graph are provided, each presenting the same information in a different way.

The three graphs all illustrate the rate of ticket sales at Kansas State University (KSU) over the last twenty years. The horizontal scale reflects two-year intervals and the vertical scale shows increments of 5,000 tickets sold. Figure 7 displays the original graph printed in a local newspaper (Seaton, 1992). It is cluttered, numerals are redundant, the horizontal scale is inconsistent, the title is within the graph, the legend is scattered throughout the data, and the accompanying article disagrees with the displayed information (the full text of the article is not contained here, only the title). The caption below the graph appears to be not centered but that is not a flaw; it is the title of the accompanying article in its original placement on the newspaper column. The reason that it appears here is because it does not match the information provided in the graph. Both the title and text of the article claim that football ticket sales have increased for the 1992 season over the 1991 season. However there is no data provided for the rate of 1992 ticket sales within the graph nor within the article.

It is confusing that the graph goes out of its way to vary the horizontal scale, yet omits 1992 information. This scenario demonstrates a typical example of unusable information that was meant to enhance an article. In practice, the reader sifts through visual clutter only to find that the comparative information is missing in the end.

Figures 8 and 9 provide alternate displays to the same information. Figure 8 employs the very popular three dimensional display in which the third dimension is meaningless. Figure 9 is not perfect, but it presents the three pieces of information in a way that can be interpreted from the visual pattern. It is an improvement over the original graph presented in the newspaper, but still omits necessary 1992 data which remains a mystery.

The critical point is that visual information is frequently misrepresented by lay people who produce data graphs without the benefit of proper guidance. This practice can be dangerous since it can confuse and mislead consumers. Computers are not responsible for poor visual design, but they make it possible for uninformed users to produce inadequate products.

Data Visualization

Data visualization is a way displaying information as an image instead of a series of numbers. It allows data from scientific events to be visualized in a symbolic, pictorial way that can seem more understandable to the lay audience and to professionals who prefer to interpret data visually as opposed to

numerically. For example, digitized computer imagery can show a tornado in action. The visual display of the tornado's dynamics allow scientists to study the patterns of wind, motion, and behavior of tornados in a way that could only be interpreted before from numerical recordings. Some other examples of data visualization include: symbolic imagery about atmospheric conditions from other planets, that has been collected via satellite measurements; visual display of data collected from a physics experiment, such as data points that represent the upward and downward trajectory of a ball as it is tossed into the air from a moving object, travelling at a certain speed; visual display of possible outcomes of automobile accidents occurring between a certain number of automobiles with specific characteristics, travelling at a particular speed under given road conditions, etc. This last sort of visual information could be used to solve mysteries about how particular accidents happened for law enforcement or insurance purposes, or it could be used by automobile manufacturers who seek to design safer vehicles.

Data visualization displays images of an event in action while standard types of graphs display patterns of numerical information resulting from the event. Even though the general public can better understand a data visualization than a set of numbers, the method is controversial because some scientists question its accuracy for displaying scientific data. These objections are not necessarily well grounded, but most likely reflect a set of values that fear removal of the traditional professional skill required to interpret the standard numerical data.

People need to know that there is something in between the two extremes of data visualization and lists of numbers; in the middle lie the various common graphs that so many people have come to rely upon. However, those graphs are limited in the type of information they can accurately display, particularly when motion and various dimensions are involved.

Power of the Image

Computer graphics and appropriate screen displays lend power to communications by adding an image to the text. Visual images can aid message interpretation and enhance learning. They can also add power to the message by providing an emotional element that is beyond that of other communication strategies. Realism can be enhanced by providing a graphic component. Images can represent realistic data ranging from simple sketches or graphs to intricate displays or vividly emotional scenes. Virtual reality can even conjure up imaginary situations through artificial imagery.

Because computers display images from peripheral devices, it is possible to display still or dynamic photos of real events. These events and their results can combine with text and audio segments to provide a sense of realism to the user that otherwise would not be possible. For example, the ABC News videodisc provides real news footage that goes beyond newsroom reporting to provide visual displays of field events. Along with the understanding provided by the realism of these events, comes the potential to stir emotions for various reasons.

Going Beyond Reality

Virtual reality offers the opportunity to remove a person from the real environment and create a feeling of living within an artificial mode. Some examples of this sort of application include specific video arcade games, airplane simulators, and architectural design software in which the user's actions are reflected visually within the software display.

Within virtual environments created by the computer, participants become part of the software environment and feel as though they are within the computerized image that is displayed. Rather than

viewing the image from without, the participants change perspective and view the image from within the software.

For example, arcade games in which the player becomes part of the game, as opposed to manipulating the game as a viewer, employ virtual reality. Instead of manipulating a lever and observing the result of its movement on a screen-displayed baseball game, the player might wear a viewing device over the eyes and a manipulative device such as a data glove to control a particular action within the game. The viewing device limits the player's view to the three-dimensional image of the game and the data glove produces simulated movements within the game based upon a realistic motion of the player's hand or arm, such as throwing a ball. This produces the feeling of actually playing the game.

Virtual reality is used within high-class pilot training in which the trainee obtains the feeling of actually flying the aircraft. Placed within a simulated cockpit the realistic knobs, switches and levers (pilot control devices) become the input devices, while the flight control panel and the windshield become the viewing devices where the pilot observes the effect of control movements. Not only does the control panel light up appropriately, but its gauges reflect the trainee's actions at the flight controls, while the control panel displays various maps of the flight path and even simulates a radar screen. All the while, the pilot views the surroundings through the simulated windshield and can observe other airborne craft in the immediate area as well as the appropriate ground activity based upon the altitude, speed, weather conditions, and general visibility being simulated. This type of pilot training usually progresses in stages from standard classroom training, to traditional computer-based training, and then on to the flight simulator for the artificial practice flight, prior to engaging in a training sortie in a real aircraft.

The third virtual reality example, architectural software, produces the ability for the common consumer to obtain the feeling of entering and moving around within an environment prior to its actual construction. A good example of this type of application is a department store which creates custom-designed kitchens. A customer can don a viewing helmet and a body movement probe in order to try out a new kitchen prior to its actual construction. Sophisticated software allows the customer to try different room arrangements while doing such things as stretching to reach the highest shelf or testing the comfort of the counter height and drawer positions.

These virtual environments are digitized images that not only display information to the visual senses, but allow the user to participate in the resulting display by contributing other communication strategies such as movement or speech. You can imagine that such images can get very complicated and can stray from the standard rules of computer screen design. Certainly artificial reality opens new doors for visual communications with computer input and display devices.

Summary

Structure, meaning, and power combine to produce effective instructional images that can be created on computers. The structure of the image considers both the components of computer images and the elements of good screen design; the interworkings of both produce effective instructional displays.

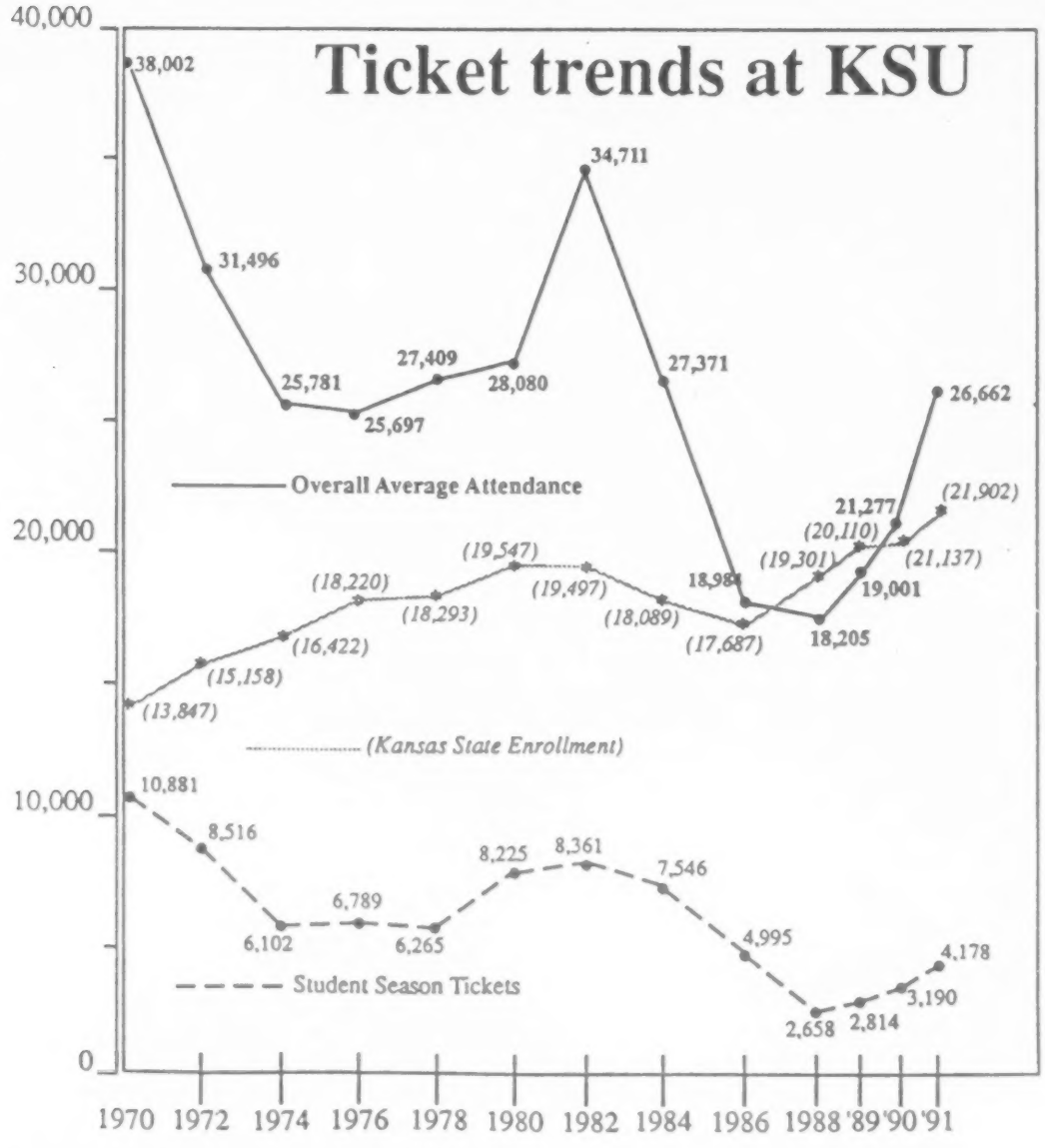
New levels of knowledge, a variety of media options, and sophisticated software, offer the ability to improve computerized images and their resulting products. Although text remains a very important part of computer communications, today's technology encourages the use of more more graphics.

Visual communication combined with sound cognitive strategies can provide meaningful messages for learners. In order to provide meaning, computer

graphic displays need to follow some rules of good design.

Understanding and emotional impact can be enhanced through powerful computer imagery. The imagery can represent real situations or it can create an artificial situation that appears to be real. Today, artificial reality remains limited to a small set of applications and is accessible to a restricted range of people, yet its future potential is tremendous in terms of visual communications and educational impact.

Figure 7. Cluttered Graph



Ticket sales show increase over 1991

Figure 8. Graph with Excessive Dimensions

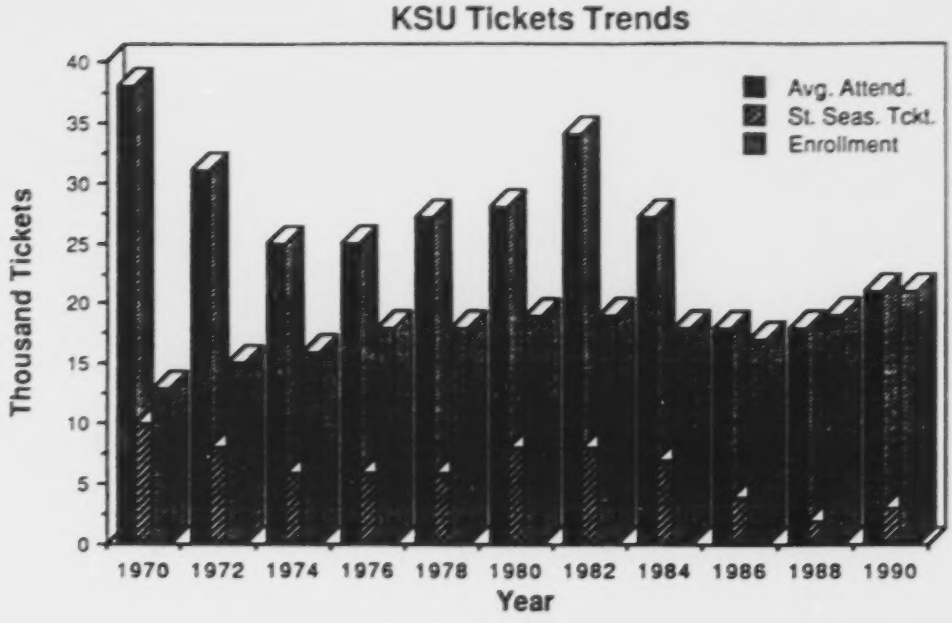
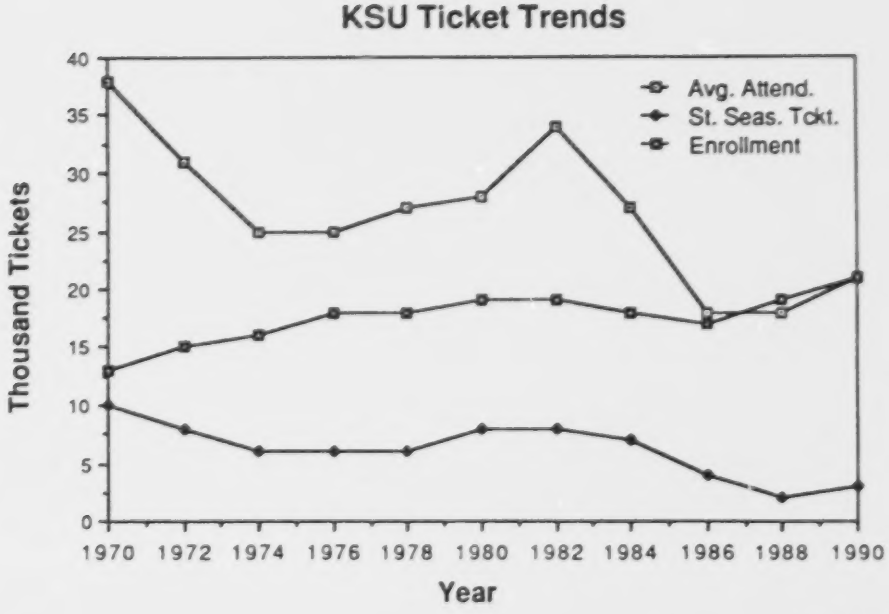


Figure 9. Line Graph



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IN SEARCH OF AN AUDIO VISUAL COMPOSING PROCESS

by
Carol Lorac

For those of us working within the area of audio visual media, it is rather like riding a roller coaster which is constantly being up-dated, redesigned, and with no consciously defined sense of direction.

Whether you are concerned with:

1. Technological development (and this effects every aspect of our work to some extent--long before the applications or effects can be appreciated, understood, and disseminated the technological wizards have moved on!

2. Economic structures, policy frameworks, or organizational practices--blink, and the rules have changed!

3. Impact on social behavior or cultural values--are the magicians in the consciousness production factory subverting reality with illusion?

4. Media practice--are the potentially diverse audio visual composing processes being dominated by the imagicians of the global tongue?

We may be grateful to discover that riding a roller coaster presents us with the possibility of two existences. The one outside which moves past so fast it remains by and large a fairly blurred sensation and the one inside whereby you try to focus on the place you have selected and attempt to make some sort of sense of it, however slow the progress seems against the speed of everything surrounding you.

This paper briefly describes the work of the International Media Literacy Project which is based at Royal University of London, U.K., and is cooperating with universities and colleges internationally. The International Media Literacy Project developed an evolving audio visual communication system and the relationship of this to the teaching of media practice in universities and colleges.

Clearly, the emergence and development of audio visual texts on television and video owe much to the pioneering endeavors of prior audio visual communication systems, namely film and radio. Indeed, the fundamental activities involved in audio visual composing processes which embrace filmic and televisual composition are the main focus of the International Media Literacy Project. However, it is pertinent to consider the specific developments inherent in television, and in particular video, because this provides an opportunity for examining how these audio visual media have extended the scope of audio visual communication systems in a number of significant ways.

The relatively recent extension of expression through audio visual communication systems, by the introduction of television and then video, has been predominantly determined by the television broadcasters and video producers in the large audio visual publishing houses. They have been developing specific types of production processes for the creation of particular kinds of media texts. This has been in response to the gradual realization of the potential for audio visual communication to cover ever more areas. The result has been the production of a whole new range of audio visual genres. Another factor has been the developing audio visual technologies which have enabled new forms of image manipulation, and through this, new types of production values and audio visual compositional possibilities.

In this environment of continually evolving production processes, it has been useful to establish the relationship between

professional media practices and communicative purposes. This has provided a way of understanding how audio visual communication systems, developed by the publishing houses, are operating. Clearly, their specific purposes have influenced the ways in which they have developed and used audio visual composing processes.

Looking at the evolution of audio visual composing processes in this way, it might be fitting to signal that when the purposes for audio visual communication are extended beyond the present publishing interests then it is likely that other audio visual formulations will need to be developed. This might indicate that a more broadly based approach to the teaching of audio visual composing processes may be relevant in preparing students as audio visual communicators.

The linking of audio visual media to computer technology will mean a more integrated audio, visual, and print communications system in the future. The International Media Literacy Project has been bearing this in mind as it has been exploring the possible ways of approaching the teaching of audio visual composition in the twenty-first century.

The increase in multi-national production and marketing strategies for television and video, and the implications implicit from the development of satellite system, has produced an international audio visual communication network and, therefore, audience. The International Media Literacy Project has been exploring whether indigenous languages and cultures, and visual and performing arts, have an influence on the media texts being created from a diversity of backgrounds; or whether the influence of global transmission of dominant audio visual compositional forms have produced an international form.

The evolution of an audio visual composing process which might have international multi-cultural roots will need to be considered in light of the developing patterns of other media--architecture, painting, and music. Clearly, the international skyline, city, motorway, airport, or shopping area have homogenized once culturally distinct architectural forms. Modern painters will often have an international *look* rather than being very nationally specific. Popular music certainly contains international sounds and is now an international phenomena. Questions reflecting the national/international debates surrounding cultural identity in a global communication era are being addressed.

The International Media Literacy Project has been developing a programme of activity which may provide ways of understanding how audio visual composition occurs in different cultural and language settings. The results of this may shed light on the role that audio visual communication might play in a range of new applications.

The international programme of activity involves teachers of media practitioners and audio visual communicators, from a large cross section of continents, collaborating on a joint piece of research which will provide extensive documentation on the ways in which they teach media practice and in particular audio visual composition. The participants from each country are providing three sets of materials: examples and extracts from national film and television output, case studies of their practical teaching strategies, and examples of their students video texts.

The compilations of extracts from national film and television output will be selected on the basis of attempting to identify a particular national *look*. This *look* may be a particularly visual phenomenon, or may be achieved by the use of specific movement or rhythm, or by some other factor altogether. Comparative analyses may produce some identification of key elements which might in turn be related in some way to a diversity of cultural visual imaging, languaging, and drama, or music.

The international case studies on teaching media practice should provide the opportunity of seeing whether there are similar general patterns, and particular individual difference, in the process of audio visual composition. Comparing these case studies will enable a cross-cultural enquiry, as well as an opportunity of identifying basic elements, in an audio visual composing process. It should also provide access to differing approaches to the teaching of audio visual composition.

In addition, examples of set assignments will be given to students and the resulting video texts will be examined to provide insights into the relationship between different kinds of audio visual teaching and the unfolding audio visual compositional forms developed by media students.

The Media Literacy Project has been looking at the audio visual composing process by examining its compositional elements. The current approach has been to look at the visual and performing arts, their relationship to human communication and the ways which their vocabularies are used within audio visual composing processes. Not only has this perspective provided a framework for looking at an audio visual communication system as a means of developing an intelligence of feeling (because of the role played by the effective domain in the expressive systems of the arts), but it has also provided a way of presenting an innovative framework for teaching media practice.

Furthermore, the results of this research programme may illuminate questions pertaining to the cultural influence on audio visual composition. We may discover specific national, cultural, and language differences or the notion of an international audio visual compositional process (which may have much to do with innate aspects of seeing, hearing, and thinking than with the global capacities of the audio visual technologies) may be reinforced.

It is hoped that by tapping into the expansion of new media programmes, within the higher education system, which have included the teaching of media practice, that it is now possible to provide information on the nature of audio visual composition--the theories underpinning the art of media practice, methodologies for teaching audio visual composition, and the relationship between teaching strategies and the acquisition and use of an audio visual communication system. This information could provide the framework for developing appropriate strategies for meeting the needs of new applications for media communication in the future.

TECHNOLOGICAL LITERACY OR ILLITERACY? THE REALITY ABOUT GREEK TEACHERS

by
Michael Meimaris

Assumptions Taken Under Consideration

Active primary school teachers are graduates of the two-year term Pedagogical Academies, which were abolished in 1986 along with the founding of four-year term Educational Departments inside the universities.

These educators have the obligation to teach the whole school curriculum; there are no specialties.

Therefore, their training on basic Sciences (Mathematics and Physical Sciences) is insufficient, being oriented mainly towards the subject matter taught in primary schools. In Greek primary schools there exists a detailed curriculum describing analytically each book chapter per teaching hour according to every subject and relating exclusively to the teaching manual-book, which is unique and obligatory for all schools.

The Greek teacher's everyday practice consists of *teaching by the book*, instead of teaching the student's relation to knowledge, using the book as an accessory.

With the appearance of new audiovisual techniques in education, the efficacy of the previous method is seriously questioned.

As a learning process we accept the theory of constructivism, based on the concepts already available to people, the construction of knowledge being the result of the active subject (Fort, 1992).

As a teaching principle we accept the following thesis: "The teaching of a certain subject presupposes the knowledge of the subject's entire domain, its evolution, and applications" (Strantzalos, 1991).

Any form of introduction of the new technologies to schools will therefore have to take into consideration:

1. The perceptions and practices of the teachers themselves about the teaching and the learning process.

2. The teachers' own knowledge about the new technologies.

3. The possibilities of a wider use of new technologies (Meimaris, 1992).

The Present Situation Concerning the Relation Between the New Technologies and Education in Greece

Educational television has been in use since 1978 without becoming functional in the process of school life.

The practice of sending video cassettes and television sets to schools in remote areas, which was done in a limited way the last few years, has not produced specific results on a regional level, nor has it had any effect on an all-round level.

For the time being, the 5,000 to 6,000 PC's that are programmed to reach mainly secondary schools and to a smaller degree primary schools, are in the process of being bought for the hardware, while as far as software is concerned, there exist only general outlines.

It has not been verified if the above mentioned PC's will be used for new technology literacy programs or as a tool of initiation to informatics, or as a new technology method of approach for the

teaching of a large number of lessons (or for office work!).

There exists a promotional yearbook on informatics, which can adhere to graduates of Computer Science, Mathematics, and Physics. It is obvious that these graduates will teach their students based on their fields.

In a number of private schools computers are functioning on a laboratory basis, but they have not been in use as a class accessory.

Special Training in the New Technologies for the Teachers

The mass training of teachers is the work of the P.E.C. (Peripheral Educational Centers) established in 1985 and functioning since September 1992. Attendance is obligatory for all active educators of all levels and specialties.

There are 14 P.E.C.'s in Greece, three of them in Athens and Piraeus, while the capacity of each is approximately 400 trainees for a three month period.

P.E.C.'s offer for the first three months of each academic year a pre-service training period, followed by two in-service periods for the remaining six months.

Thus, it can be assumed that in the next eight to ten years all Greek active educators will have completed a three month training period on the P.E.C.'s.

The function of P.E.C.'s provides lessons five hours daily, five days a week, for a three month period of audio-visual as well as new technology lessons and computer laboratory cover respectively one and two hours weekly: i.e., we have 10 hours of theory and 20 hours of practice (hands-on) for teachers per training term.

Outside the P.E.C. structure there are held, occasionally, special training seminars on computing languages, logo, word processing, spread sheets, etc., usually as an initiative of private and social sources--communities for example. The teacher's participation in these multi-hour and not clearly education oriented seminars is limited.

Teacher trainees have not received lessons connected with the new technologies and computer science during their basic education in the Pedagogical Academies.

Basic Elements of Training in New Technologies During the Three Month Term of P.E.C.

During the ten hours of theory the following subjects are examined:

1. Basic elements of computer science and N.T.'s (Binary system, computer configuration, networks, hypermedia).

2. Examples of educational video cassettes (Greek and foreign productions).

3. Initiation to educational television (from the conception and design of a scenario to the production and distribution).

4. Examples of multimedia educational products (CD-i with disks from Smithsonian Institute, Time-Life, Van Gogh, and applications for children).

During the 20 hours of lab work, with two persons per machine (PC's 286 network with a 386 Host computer), the following subjects are examined:

1. Familiarization with the machines.

2. Basic principles of MS/DOS.

3. Word processing.

4. Examples of Logo an different school data processing applications.

The Questionnaire's Design and Procedure

The questionnaire is designed in such a way that will permit the investigation of:

1. Teachers' literacy in the N.T.'s and their ability to use them.

2. Teachers' pre-existing opinions-attitudes concerning the introduction of N.T.'s in education, especially in relation to their own training and school curriculum.

3. Their relation to educational television.

4. Their potential to organize a lesson using different elements based on the N.T.'s.

The questionnaire was submitted during the function of the P.E.C. in Piraeus, in two training terms, the first concerning pre-service training and the second concerning in-service.

About eight hundred (800) educators of all levels and specialties from the greater Piraeus area and the Cycladic and Dodecanese Islands were questioned.

Methodology

For the analysis of the complete set of data, linear (factor analysis) and non linear (cluster analysis) statistical methods have been used. More specifically: Correspondence Analysis (Benzecri, 1973) and Ascending Hierarchical Classification have been employed for the exploration of the latent structure of different data matrices constructed from the initial table of data (Meimaris, 1978).

First Results

Complete data processing being under way as these lines are written, we are obliged to present here elements concerning the pre-service training of primary school teachers.

In this phase the questionnaire was addressed to 120 pre-service teachers of primary schools:

- 73% female and 27% male,
- 65% 26-27 years old,
- Half of the above were graduates of regional pedagogical academies,
- 80% had graduated in 1986,
- all had experience of school teaching as substitutes,
- 31% had given private lessons,
- 73% had a teaching experience of more than three years,
- 9% (11 persons) owned a PC; six of them used the PC regularly and only one had the proper training,
- Out of the total number of 120 teachers, only four had been trained in computers of whom two neither own nor use a PC; only four use a PC at school and of those only one had the proper training.

In reference to the question about the teachers literacy in the N.T.'s, we note among others the following results:

Items	in relation to computers	no relation	don't know
mouse	26%	21%	42%
diskette	82%	7%	7%
software	46%	2%	37%
fax	36%	34%	18%
logo	16%	18%	49%
0-1	14%	2%	65.5%

Concerning the question about whether they have attended educational television programs, they answered:

62% yes, 27% no, and 10% gave no answer, while they had an overall positive view concerning its educational value and its assistance towards the lesson's better comprehension.

Concerning the hypothetical existence of all the new technology items in the classroom, they prefer television and video as an accessory to teaching, and to a lesser degree the computer, especially in matters of the environment. As a mode d'emploi they propose a projection followed by discussion and commentary.

Looking to the introduction of the N.T.'s to education:

In Relation to the Educator's Training

1. 17% propose only for mathematics teachers to be trained in programming languages and use.

2. 47% propose short term training for teachers of all specialties oriented toward programming languages.

In Relation to School Curriculum:

1. 39% propose the introduction of a special lesson on informatics,

2. 45% propose the creation of a computer lab,

3. 26% prefer the introduction of N.T.'s to school through the different already existing lessons without creating a new one.

Discussion

It appears that the ownership, the use, and the training in a personal computer are in themselves quite different things.

This in itself is unavoidable but as far as educators are concerned it breeds certain dangers about the implementation of the N.T.'s in education.

In an educational policy it would seem quite an easy thing to obtain a personal computer for work at school or for the teachers training (at home, with the help of a grant as is the case for buying books). The difficult thing is the proper training in the new technologies and their multiple uses.

This training will have to cover the cost of both the initial phase of training and the hands-on phase as well as the observance of real-life teaching situations with the use of PC's, and to foresee future uses.

Therefore, more time is needed before educators can arrive at a level that will permit them to organize experimental educational scenarios.

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SCHOOLS AND TECHNOLOGY IN A DEMOCRATIC SOCIETY: EQUITY AND SOCIAL JUSTICE

by
Robert Muffoletto

Questions need to be addressed concerning the role of education and technology in a fair and equitable global political and economic system. As individuals, and as a profession, involved in the research, development, production, and dissemination of educational experiences for children and adults, we need to consider what we have created and will create in light of social justice and democratic principals.

Our history in educational technology is full of attempts to design and produce effective learning environments. (I realize it is not our history but *a* history that has evolved out of conflicts and contradictions representing various interests. There are many histories, many voices yet to be heard.) We, as a profession, have consumed various learning theories and have produced various formats for the delivery of educational and instructional materials. Our collective purpose has been to increase the effectiveness of teaching materials and the efficiency of the learning process. At the same time, our purpose has been an ideological one. The materials we have and will produce speak of us and others in ways which construct them as we wish to see them. Technology is not a neutral conduit, but an ideological apparatus. It speaks of the world as *we* have created it.

Our field is grounded in logical positivism, capitalism, and a 19th and 20th century notion of progress and classical realism. Technology, both as machine and as system, was and is linked with modernism and progress. Reality, especially social reality, and the stories told about it by experts, is understood to exist outside the individual and has for the most part gone unquestioned and unrecognized by researchers in our field. Beneath all of this lies the ideology of the machine and the expert (Muffoletto, 1993).

Our field has strived to create through various presentational formats *a* reconstructed reality. Most of the debate in these attempts has centered on the veracity of the experience; does it feel real, does it reflect reality, is it efficient, and is it effective in its delivery. There has been little debate on the consequences of those strivings for a reconstructed reality on the lives of real people and their culture. With the recent developments in virtual reality and multimedia hardware and software we must begin and continue our attempts to address the psychological, social, and political implications and effects of what *we* do as perceived experts, as educational technologists and media educators. No longer can we afford to claim the neutrality of a modernist tradition or the non-historical consciousness which accompanies a positivist discourse towards reality and experience. As educators, researchers, and developers of learning experiences we must find avenues and entry points for debates and practices that argue and provide for spaces that support and maintain democracy and social justice. The first step I believe is to recognize ourselves for what we are: a social, historical, and epistemological construction. The second step is to define what we mean by democracy and social justice. The third is to position our definitions in practice.

Technology as a Medium for Discourse

Technology is more than a tool, it is a medium which effects how we think and

interact with others and machines (Rheingold, 1991). It is a form which not only controls and limits discourse but determines the nature of the content as well (Postman, 1992). Technology is more than access to information and learning experiences. Technology determines the nature of that information as well as our understanding of it. As a medium of experience (discourse), technology effects our consciousness, our visions, and our expectations. The *wetware* of a modernist technology constructs the individual as a subject (Berger & Luckmann, 1966; Muffoletto, 1991). The technological medium is more than a mind manager and a reality simulator, it is a consciousness generator --an ideological horizon line.

Information

If technology is to provide us with access to information, there are a number of issues that must be considered and addressed. Simply providing access to information is not enough in a social context where historically access has been limited to the wealth, gender, and race of the individual or community. Access to information must also include equity in access to ways of *thinking* about information. If information is to be used to empower people within the democratic tradition, then educational experiences must provide a means for equal access to ways of thinking as well as valuing different ways of thinking.

To have information and not know what to do with it, is as serious problem as not having information at all (of course this begs the question about the nature of information, epistemology, legitimization). Individuals who historically have been positioned on the margins of power and knowledge because of their culture, their economic class, their gender, their race, or their religion, may have been given equal access to information (even in limited ways), but not ways of knowing (thinking). For example, the cultural ways of making sense in the United States has been limited to primarily one cultural and economic framework (white, middle-class, male, and European). How one thinks about the world and one's self in it determines the rationale for understanding why things are the way they are (common sense), and not why reality is thought about in that manner.

How one thinks about the world as well as self, is how one has been told to act and think in relationship to self and others. Having information, but not divergent ways of thinking, maintains the individual and the community in a powerless relationship to those who do. Having access to information may create a false consciousness resulting in less real power than before.

Simulations as Experience

Virtual reality, as a technology of experience, poses a number of questions. First and most basic, we must consider what the relationship is between a *virtual* reality and something we call reality. Is it good enough to be concerned with only the veracity of the experience and its correspondence to what is believed to be out there? (The physical and social sciences can be separated here, but questions concerning how we know reality and truth are essential to both paradigms.) In doing so we must offer up for analysis the manner in which we came to think about what is out there. We tend to forget that our understanding of what we think is out there is a result of the tools we use to explore it, the language we use to construct it, and the beliefs and context used to understand it and give it meaning (Goodman, 1978; Rorty, 1991). Change the tool, the language, or the system, and reality differs. As individuals concerned with the creation of simulations, other worlds, we can not forget that we exist within a social reality, a virtual realty of sorts. We must also recognize that through discourse management, our constructed reality has become reified and objectified.

Second, if virtual reality is understood in terms of simulations, looks, feels, and sounds-alike, virtual reality

must be understood as a discourse. As a discourse virtual reality must be analyzed as any other discourse? Borrowing from Cherryholmes (1988) we would need to question virtual reality by asking: Who is controlling the discourse (reality)?; Who is allowed to speak and listen?; What is being said?; Who benefits from what is being said?; as well as, What is not being spoken?

Any simulation or virtual reality must be considered from two different perspectives. On one side we must consider who is constructing the world to be experienced by users (students, teachers, workers, infonauts). Notions concerning hypertext environments, interactive video, and virtual reality include authors and readers, guides and travellers, navigators and explorers. No technological environment, as a system, is authorless. Every author, every programming production team, every navigator, holds a world view, an ideological perspective, a consciousness about self and others. On the other side, we must consider the social, psychological, and political effects of a constructed world on the readers of the virtual text.

Social Learning

How *we* come to be as subjects, as social beings, is a result of experiencing constructed texts (texts is used here in a post-modernist manner) and meanings (Belsey, 1980). All texts are hegemonic and are part of a larger discourse encoded with meanings, values, and ideological perspectives on others and self. How and what we learn about a social world is the result of experiences with various discourses about that world. In doing so, we either reproduce dominate meanings and ways of knowing or offer oppositional and alternative discourses (Hall, Hobson, & Willis,1980). In either case, individuals as members of interpretive communities (Fish, 1980) understand a reality to be as it is, to be real and truthful, because of their experiences with various formative and informative discourses (Ellsworth & Whatley, 1990). Questions referring to equity and social justice emerge out of a discourse on social learning, power and control, benefit, and history.

School Reform and Technology: Towards Social Inquiry and Justice

Curriculum materials, delivery systems, and learning environments may be understood as social texts, representational in nature, always overtly referring to something else, while covertly referring to themselves as a formative medium. The form and content of learning environments not only speak to methods and content, but also refer to ways of thinking and knowing. Thinking about all learning environments, methodologies, and contents as representational, as ideological representations, adds another dimension to our thinking about schooling, technology, and change.

Change always refers to difference. In education as well as business, change is considered as a reply to some identified problem. How these problems are identified is as important to understand as what the problem is reported as being. Needs assessments, goal development, and vision statements refer to a history, the present, and to a future. Futures are normally related to notions of progress.

What the problem is, is determined by who (who being not an individual but a community) is asking. If problems and solutions are defined in terms of efficiency, outcomes, and management, the problems and solutions will be of one nature. If problems are contextualized in a discourse of democracy and social justice, efficiency, outcomes, and management may be part of the solution but to *what and how* they refer to will be different. As education in the United States considers why and how it must change, technology as a medium which effects knowing, institutional and individual relationships, as well as a sense of self and others, must be better understood within a discourse of democratic ideals. The problem needs to be redefined. (Again, the language has to

be problematic when we consider that there is not one education, but many.)

Critical Theory and Educational Technology

Critical theory offers an entry point for unpacking the values, assumptions, and practices of educational technology. From a post-modernist perspective critical theory claims no absolute authorship. It declares its own subjectivity and ideological construction. As a theory working within a post-modernist tradition, those who practice critical theory are concerned with questions of power, control, and epistemology as social constructions with benefits to some and not to others.

A critical theory of educational technology would be concerned with issues of consciousness and epistemology, power and control, institutional and individual relationships (Feenberg, 1991). Questions concerning equity and social justice, and the construction of individuals as subjects within an ideological discourse would be critical to the unpacking and redefinition of the theories and practices of educational technology. A major impact of critical theory on the field of educational technology would be to recognize itself as a social construction with a history of conflicts, struggles, and contradictions. In understanding the social and historical nature of the field, the values and assumptions which are expressed through various discourses would be open for analysis.

Conclusion

Schooling, in reflecting a democratic society, requires a society to be democratic, non-racist, non-sexist, and not class based. In positioning education as a major socializing institution, with a major role in forming the world views and subjectivities of its participants, the products and processes of educational technology do play a major role in how communities of individuals think about others and self. A critical theory position, breaking from the common sense reified world offered by modernist and positivist alike, would need to address issues concerning the function of schooling and a technology of instruction in a democratic society.

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BEFORE THE CHALLENGE

by
Demetres Pnevmatikos

Quality in education is a central preoccupation in all developed countries. Improving the quality of basic education--primary and secondary--obviously comprises a number of changes in curricula, teaching methods, and the organization of schooling with particular emphasis on the role of the teaching staff. On the other hand, teachers have begun to be dissatisfied with the inability of the school to link school and society. Many teachers, also, have turned towards technology because of "a felt need to reflect the nature of our rapidly changing society in education and to underline its relevance for all pupils" (Dodd, 1978, p. 37). From this point of view, education has always followed technological advances in trying to apply scientific achievements to teaching practice. Contrary to the other fields, educational technology is characterized by a lack of targets. Although, multimedia applications, for example, promised rapid changes in education, there is no plan to assimilate these ideas and knowledge. Therefore, it is time for education to define its targets in aspiring to the school of the future and call in experts that could solve the problems that might arise. This implies that the psychologists, pedagogists, and computer scientists should cooperate to solve the problems which arise. In order to show what I mean exactly, in this paper I shall attempt to describe the school of the future and I shall point out some of the problems that must be resolved from each science.

The School of the Future

Forgive me, if the first part of my proposal seems like a science fiction story but as Denis Healy (1987) said: "The application of information technology to education requires new and imaginative approaches" (Lesgold, 1987, p. 13).

Classroom Organization

The structure of a classroom in a school of the future will not be too different from a current classroom. The classroom will still have its blackboard. On one side, behind the teacher's desk, there would be a screen whose size would vary with the size of the classroom. On the teacher's desk, there would be a high capacity multimedia system, equipped probably with peripheral CD-ROM, full-motion video, touch sensitive screen, voice/document delivery system, printer, etc. On the desks there would be PCs equipped with appropriate software for every lesson. They would have a CD-ROM as well as CD-WRITE and an on-line link with the school's library.

Class-Student Organization

A common feature of all students of each class will not be their chronological age but the possession of the same level of cognitive abilities, corresponding to the requisite level for the comprehension of every unit of the lesson. Students would be tested on every subject and assigned to a class in accordance with the results.

Library Organization

The school's library will not have books, magazines, or newspapers. It will have a computer capable of linking with databases and in a short time it will be able to provide information for everything that has been written, providing writing ability of information on a CD-ROM, for further processing, for every type of school There will also be in the library a relevant software series with multimedia encyclopedias so that students are informed directly. The contents of encyclopedias would be graduated according to the level of cognitive demand.

Curriculum and Syllabus Design

If we accept that the spectrum of scientific knowledge of every scientific region is reproduced almost every ten years, it is apparent that the curriculum should be reorganized and the educational values required in future life should be evaluated. Therefore, the curriculum's objective targets will provide to its students a fundamental body of knowledge for every scientific field. They should stress the cultural educational values of each country and encourage a sense of universal moral values in combination with the commonly accepted educational values which would be necessary for the conservation of our planet. The curriculum will put on a scale the knowledge, based on the allocated abilities which are required for their resolution and they will provide to students the ability to attend courses according to the development of their capacities, putting into practice the individualization in teaching. There will be lessons which will help students acquire a clear picture of the way they operate as cognitive beings, laying equal emphasis on metacognition (Flavel, 1979; Wellman, 1985) and on knowledge. The content of the lessons will be clearly defined but beyond the fundamental knowledge, it will provide the opportunity for a broader exploration of the lesson. It will also pose the unanswered questions which engage the field of the lesson for the students to consider these subjects in depth. Teachers, to accomplish every lesson targets, must have the opportunity to select from a series of alternative methods, one of which will correspond to the special need of each student's socioeconomic status.

Teaching Organization
Lesson Planning

Teachers will be aware of students' capacities for the acquisition of new knowledge, and they will also have a clear picture of students individual differences and will be aware of the factors that would potentially affect their teaching. Collaterally, teachers will have in their possession plenty of media and methods to succeed in their target. Teachers shall develop in this way to the maximum degree, the technological potential. Initially, they will be able to present the lesson plan on the screen and pose the questions that will occupy the class during the lesson. By using the multimedia system they will be able to give a vivid picture of the phenomena they will teach not only in laboratory conditions but also in real conditions. Students will be able to experiment on the computer themselves through a simulation program, to search for other useful information from the library, to transmit new knowledge to new applications. To establish the unanswered questions and to formulate possible solutions for these questions or, even better, to experiment about their resolution. Finally, students will be able to evaluate themselves by answering the special test made to test the degree of acquisition of new knowledge. The computer will be able to process (aided by a statistical program like SPSS) the answers automatically and to give the picture of every student's record.

Development Pace
Student Grading

This system will assist the continuous assessment of the students' progress. When students rise to a higher development level in some lesson and possess the fundamental knowledge, then by rights they will be able to attend the lesson at the same level. This means that the importance of the course is not limited to the acquisition of the necessary knowledge but also to the development of cognitive abilities, of self respect, of self awareness, and of meta-cognitive awareness.

The Problems With Computer Science

Multimedia systems provide the potential for multi-sensory presentations and therefore in addition to the fact that they maintain the student's attention during

the lesson, they have the capability to accelerate and improve the comprehension of information. It is a fact that computer science has succeeded to many applications which only a while ago belonged to the field of science fiction. This fact allows us to be optimistic about even more applications in the future. Since 1978, when Philips Laser-Vision was first presented (it was based on a video disk appliance which had the ability to store pictures) we have seen until now more complex applications concerning live video and sound in analogical form. The CD-ROM, the VGA card of IBM, Apple's logismic Hypercard, have progressed to more complex applications like voice/documentary delivery (Scherr, 1989), CD-Write (Udell, 1993). Very simple educational applications have progressed to the Computer-Aided Language Instruction (CAL), (Last, 1984), or the educational encyclopedias like MAMMALS Multimedia Encyclopedia (one complete encyclopedia for the animal kingdom of mammals based on Hypertext), Compton's Multimedia Encyclopedia, the concise Columbia Dictionary of Quotations and Hammond Atlas. In other words, the new information technology offers a wide variety of programs covering nearly all the stages of learning. However, building one's educational program presents some problems. Some of them I shall try to describe now. I will not go into technical details as I am not an expert in this subject. However, I will point out some of the problems that researchers have detected in an attempt to apply useful educational programs for us to have an understanding of them.

Researchers from the Center for educational Research and Innovation (CERI) who consider the building of educational programs for mathematics, emphasize that creating of such programs must include "knowing what the problem is and knowing a method of solving it" (Howe, 1987). Therefore, in building such a program for computers "we can distinguish errors which are due to the inexact or imprecise conceptualization of a problem from errors occurring as a result of representing the problem in program form" (p. 235). That implies that first of all we should have a clear and documented view about the structure of the problem and secondly we should command proportional flexible methods and techniques which will allow us to transmit this structure into the program explicitly. Dr. Jean-Paul Haton (1987) has considered artificial intelligence research for systems that would be able to use all the knowledge, including human expertise, available in a given domain. He considers the application of knowledge-based techniques to understanding systems, especially speech understanding and computer vision where the basic problem consists of interpreting input physical data. In these two related fields, Dr. Haton notices: "there exists a close interaction between numerical data-processing (perceptual aspects such as in signal processing and pattern recognition techniques) and symbolic computation (cognitive aspects). Moreover, it is difficult to implement reasoning processes due to the multiple knowledge sources and to the fact that data are incomplete and/or erroneous (p. 1). We should therefore command a clear view of the symbolic operation of the human's cognitive operations to project them later on in computer operation. We should also know which of the human capacities can be developed by computers and which can not.

Sperandio and Scapin (1987) point out the problems of the ergonomics aspect in man-machine communications:

> Speaking to the machine in natural language may seem more natural than using a keyboard. It is certainly more natural, but not necessarily faster nor safer. First of all, today's machines recognize spoken words only within boundaries that are much more restricted than man to man communication. This technological constraint requires the operator to speak in a more stereotypical way than in everyday life, and to use a

> reduced language. Therefore, the user has a greater risk of violating these boundaries, these rules, than if he/she was using a more classical entry mode, such as a key-board. Current software design can sometimes be described as an art rather than a science, depending more on individual judgment than systematic application of knowledge. It is that knowledge, both in terms of methods and existing results that software ergonomics can provide. (pp. 83-84)

In other words, planners of educational curricula should select from the superabundance of offered techniques the most operative. Even though all programs of new information technology are material well produced, Professor Gilbert de Landshere (1987) pointed out that taken in isolation, and not seen as tools for use in an educational project, many of them are of dubious psychological and pedagogical value. Therefore, criteria of courseware description and evaluation must be adapted, improved, and extended. It is customary to consider the user interface (screen layout, forms of control and feedback, nature of dialogue), the technical quality of the program, and its pedagogical structure and function.

Psychological Problems (Cognitive Sciences)

Cognitive science emphasizes the role of prior knowledge in learning. We have already pointed out the need of the computer programmer to know the exact operation of the human mind to construct a new educational program for a computer. Furthermore, in the first part class organization based on the same level of cognitive abilities in each domain of knowledge was discussed. However, there are many different aspects of the growth and organization of cognitive abilities. Jean Piaget (Inhelder, 1963) suggests a holistic model for the structure and development of the mind. On the contrary, neo-Piagetian researchers propose more flexible systems for the architecture of the mind. Demetriou and Efklides (1993) suggested three different systems (the processing system, the hypercognitive system, and the specialized structural system) in which the human mind is structured. The first one refers to the most general system of intellect. This involves components which are so general that they are present in every intellectual endeavor. The second one, the hypercognitive system, does not have solutions to problems. It simply directs the mind, when it is in a state of uncertainty, to select a course of action that seems more relevant and promising, given the presentation(s) of the solution of the problem. The specialized structural systems are complex modules involving concepts, mental acts, schemes, or operations interconnected into networks that make their co-activation possible for the sake of particular mental goals. These networks may be conceived as abilities. That is to say, they make the person able to understand whole domains of reality and they structure the action required for efficient interactions with the elements of these domains. From this aspect, the mind is conceived more as a network of relations connecting the intellectual units into systems which are functional vis-à-vis the demands of specific environments in the individual's own history (Demetriou, Efklides, & Platsidou, 1993).

Therefore, the structure and organization of knowledge in every special field of reality should have a particular inner structure and organization and should follow a particular developmental rate. This means that the exact structure and developmental rate of every field of reality should be explored and later on educational programs built which would take into account all these specialties. A first step towards this direction, pertaining to religious thinking has already been done (Pnevmatikos, in preparation). It was established that although students possessed the corresponding abilities for a higher level of religious thinking than the one they demonstrated, they remained, however, at a lower level of religious

thinking. The factor which was of significant influence was the socioeconomic status. That means, that research beyond the structure of every form of complex thinking, should be turned into pointing out explicitly all factors responsible for the creation of individual differences. In other words, one must specify precisely the manner in which knowledge is acquired and built in every domain of reality and secondly one should define all factors which are responsible for the creation of individual differences. Today there is no doubt that a thorough analysis of the domain specific knowledge of a person is a necessary requirement for understanding the person's problem-solving activities in each domain (Glaser, 1984). Beside that, there exists a need, as many agree, "metacognitive processes should receive more consideration in development of teaching programs. A teaching program should help explicitly to acquire mechanism to control and monitor the domain-specific knowledge and cognitive skills" (Corre, 1987, p. 167). What is the relevance of metacognition to each one of the fields of reality? Does their influence occur in the same way in all developmental levels? These are questions that should be answered. For the time being, "recent studies of training in the development of cognitive strategies demonstrate the success of cognitive and meta-cognitive training measures with students with learning disabilities, students with different levels of maturity, and students in different college semesters" (Corre, 1987, p. 167).

Psychology should research the structure of every particular field of human knowledge, should build hierarchical developmental models for each one, should point out the relations between each level of development of this hierarchy and the cognitive abilities and metacognition, and finally should specify the responsible factors for the creation of individual differences as well as the manner in which these factors interact in each field of reality. This point needs attention because the success or failure of every course will be dependent upon the reliability of the research and also upon the aspect that will be adopted for the architecture, structure, and development of the human mind.

Pedagogical Problems

In recent years much has been learned about expertise in many different areas, and one way to view education is "as the conveying of expertise to children. We continue to expect our children to be *facile* at the basic skills of reading, writing, and arithmetic computation, but increasingly, we also expect them to respond flexibly, like experts, to continuing technological change (Lesgold, 1987, p. 20).

On the other hand, time exerts great pressures on education. Pressures produced by the time problem combined with other weaknesses of educational systems have led to widespread belief that educational standards have been lowered. The rapid pace of our society, and particularly the media, reinforces the belief of many children that skills can be acquired very quickly. Most teachers do not have the opportunity to attend a training course during their career. In science the amount of important knowledge continues to grow and it is easier for those responsible to add to the curriculum than to redesign it. This is the picture of education all over the world. The curriculum of the school of the future must be redesigned. We will soon have a new cognitive science telling us how learning takes place and what is learned from certain standard components of schooling. We need to turn to our advantage new skills, new tools, new teaching methods, new time, and student division.

Conclusion

We have considered the school of the future. We have also pointed out some of the problems that should be solved. This demands hard worked from many scientists and the joint efforts of various scientific disciplines in order that our

dreams should be made reality. It may also be necessary to outlay a lot of money at time for scientific research. So much scientific potential and such a prohibitive amount of money is impossible for only one country to provide. There is the need to create an international institute which should research and join the efforts between the institutions all over the world. Furthermore, the national institutions should be activated to define their educational values and national ideals. They should also describe those specific factors of their nation, that would create the differentiation environment in which the cognitive abilities are growing. However, this is a vital question: If today a great number of illiterates exists all over the world, what is going to be the number of illiterates in the future under the new demanding conditions? This question needs to be answered.

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TEACHING WITH DISTANCE DELIVERY SYSTEMS: STRATEGIES FROM A TO Ω

by
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Though nuances of the definition still are debated, the term *distance education* broadly refers to a wide variety of educational activities conducted when the source(s) and recipient(s) of the educational event are geographically or temporally separated (Garrison, 1990; Keegan, 1990). Distance educational can assume a variety of forms, from very traditional courses provided via videotaped lectures to computer-mediated communication among teachers and students that occurs when participants' schedules allow them to send and receive electronic messages. Though time-honored, print-based correspondence courses are indeed considered a form of distance education, developments in technological hardware and software provide means of instantaneous, live, two-way interaction among instructors and students. Technological advances now offer distance education participants communication options such as audio, audiographic, facsimile, compressed video, VSAT (Very Small Aperture Terminals), microwave, satellite, cable, computer-based, and a variety of other delivery systems. Indeed, distance delivery systems frequently are hybrid systems, taking advantage of the attributes of a variety of delivery technologies.

The focus of this paper, however, is not on the new delivery systems (for a concise overview see U.S. Congress, Office of Technology Assessment, 1989, Chapter 3). As with any type of educational hardware, distance delivery systems themselves serve as the tools of teaching and learning, not as the primary consideration. Though the attributes of distance delivery systems must be considered during the design and development of distanced education endeavors, traditional principles of instructional design and development continue to serve as the foundation for educational planning. However, participants using new technological delivery systems may require assistance in learning to engage successfully and serenely in distance teaching and learning. This paper focuses on tips and strategies for educators interested in expanding their teaching repertoires to include the use of distance delivery systems.

In honor of the nation of Greece, host country of the 1993 Symposium of the International Visual Literacy Association, strategies for teaching with distance delivery systems are associated with each letter of the Greek alphabet and are discussed below. Since many distance delivery systems are available, strategies are generic and can pertain to the use of both audio and visual systems incorporating either live or delayed communication with a variety of learners. This brief overview of strategies is merely an introduction to the many opportunities awaiting educators who engage in distance teaching.

Attitudes. Educators engaged in distance teaching must carefully assess their attitudes about distance education. Teacher predispositions can be a crucial factor determining the success or failure of distance programs. Attitudes of students, administrators, and other stakeholders are important as well, but an unhappy teacher forced into a distanced role can sabotage a program just as a committed teacher can contribute the energy and enthusiasm that leads to the success of the endeavor. Wise distance teachers know about both the strengths

and limitations of distance education and believe it is a worthwhile endeavor.

Barriers. Distance teachers are overcoming barriers of time and geography, just by the nature of distance education. Other barriers, ranging from tight budgets to luddite colleagues to administrative red tape, often present obstacles to educators teaching at a distance. Wise distance teachers identify existing barriers and develop strategies for dealing with them, knowing that new barriers will arise to present additional challenges.

Groups. As the role of educator shifts from that of a dispenser of information to that of a facilitator, coach, and mentor, teachers are increasingly incorporating student group activities into the instructional process. Group assignments can be a challenge to arrange in a distanced context, but they can be a very beneficial element of the distanced educational experience. Careful preplanning, assignment of group roles and responsibilities, use of on-site facilitators, and frequent communication among group members and the instructor all support the inclusion of group work in distanced settings. Wise distance teachers take advantage of group options during instruction.

Determination. Distance teaching is not easy. Those who naively state that teaching at a distance is just like teaching in a face-to-face situation probably have never taught at a distance. However, distance teaching is not necessarily harder than *normal* teaching. It merely requires the determination to incorporate new teaching strategies and to modify traditional ones in a new type of learning environment. Wise distance teachers are determined to provide successful experience for their distanced students and will select strategies to do so.

Evaluation. Distance teaching requires that educators consistently evaluate not only the performance of their students, but the successes and limitations of the entire distance teaching experience. In a distanced context, teachers will want to evaluate their own performance; the appropriateness and effectiveness of the delivery systems; and the support received from administrators, staff, site facilitators, and technicians. Wise distance teachers will solicit assistance with evaluation of the many factors affecting the overall success of distanced teaching endeavors.

Zest. Just as a teacher's enthusiasm is contagious in a live classroom, a distanced teacher's zest is transmitted across geographical space and over time. Wise distance teachers will remember that their degree of zest for distance teaching and learning will be translated to students using audio or visual means and that students will perceive and often reflect that enthusiasm.

Eerie. Sometimes teaching at a distance may seem a little strange. Depending on the type of delivery system being used, a teacher may have the eerie feeling that no one is *out there* attending to instruction. Feedback is important to teachers as well as to students in order to combat an eerie sense of isolation. Teachers may also feel a little unsettled when working with new delivery technologies for the first few times, but comfort levels rapidly rise as teachers become accustomed to the hardware and to the strategies to take advantage of new teaching options. Wise distance educators realize that eerie feelings will be replaced

by a new sense of confidence in dealing with distanced teaching situations.

Thoughtful and Thorough. Teaching at a distance may encourage a teacher to be more thoughtful in planning instructional activities. When using some distance delivery systems, a degree of spontaneity may be sacrificed in order that predetermined materials arrive at distant locations in time to be used in class. Wise distance teachers use this fact as incentive for timely, thorough preparation of materials and for prior planning of instructional strategies.

Interaction. Interaction frequently is considered crucial to good teaching and learning environments. When working in distanced contexts, teachers may wish to be especially mindful of the opportunities for interaction that they build in to lessons. Simple strategies such as calling on students by name, assigning students from distant sites as spokespersons or equipment operators for the group, directing students to ask questions and interact directly with each other, assigning group tasks, requiring individual or group reports during class, and other activities that encourage interaction in face-to-face classrooms often can be translated to distanced classrooms. Though the attributes of some delivery systems may tend to limit interaction, wise distance teachers use their own creativity and expertise to overcome these limitations.

Kinks. Working with distance delivery systems usually means working with technology, and hardware glitches at one time or another. Distance teachers also will face kinks in the smooth operation of a distanced program due to human factors. Wise distance teachers do not let kinks in the system tie them up in knots, and they proceed to the best of their ability in the face of challenges.

Learners. Learners are a crucial variable in the successful distance education equation. Wise, learner-centered distance educators will realize that their educational philosophies and classroom strategies that focus the educational act on learners and learning rather than teachers and teaching can be translated to distance situations. Some of these strategies may include the use of student-negotiated learning contracts including identifying the objectives and grading criteria, a consideration of students' learning style preferences in instructional planning, and encouragement and validation of student ideas and comments.

Media. Media such as slides, laser discs, audio recordings, videotape, and graphics can be selected and incorporated appropriately into distanced contexts just as they are in live face-to-face teaching settings. Though copyright issues, distribution schedules, and fidelity of transmission are just a few of the concerns that arise when supplementing distance instruction with additional media, wise distance teachers realize that principles of communication and learning that support the use of educational media in face-to-face situations apply in distanced contexts as well.

Needs. Distance education currently is in vogue. Unfortunately, many educators select distance education as a trendy *solution* without determining what *the problem* is or whether a problem exists at all. A wise distance educator will help determine the needs of the school or institution which is considering distance teaching and learning options. Once needs are identified, distance delivery systems and solid

instructional design principles can assist in the development of appropriate distanced interventions.

Xerography. Distance education endeavors often extend beyond the dissemination of print-based instruction, but xerography, facsimile, and other print-based technologies still support distanced teaching endeavors. Distance teachers may choose to distribute copies of graphic and written information to distanced students to reinforce other teaching-learning activities. Wise distance teachers will take advantage of the speed and general accessibility of facsimile and xerographic technologies to supplement their distance teaching with print-based materials.

Organization. Distance teaching requires a great deal of organization on the part of the teacher and the many types of people involved in distanced endeavors. Wise distance teachers will draw upon principles of instructional design and development to help organize their instructional responsibilities and will work closely with colleagues to organize all aspects of the distanced teaching and learning experience.

Punctual. In many instances, distance delivery systems are leased, rented, or otherwise scheduled to be used for specific finite blocks of time. Some delivery technologies, such as satellite transmission, may begin and end precisely at predetermined times, regardless whether or not an instructor is running late to class or is in mid-sentence. Wise distance teachers will be punctual in starting and ending class sessions, particularly when the technology is unforgiving.

Repetition. The old adage, "Tell them what you're going to tell them, tell them, then tell them what you told them," rings true for distance educators. Distance teachers will soon learn that repetition of assignments, due dates, and key points is appreciated by distanced students who want to confirm that they are not losing any valuable information due to transmission noise or other technological or human interference. Wise distance teachers will repeat important points and confirm that the students have received the messages by asking students to restate the information themselves or to respond in other appropriate ways.

Simplicity. It may be a tendency of human nature that some educators want to use the newest, most complex, most dazzling technologies available, and this inclination often holds true in distance education contexts. However, the goals of a distance education endeavor often can be reached using simple delivery systems, alone or in hybrid combinations, in effective ways. Wise distance educators realize that simplicity of presentations and delivery systems often is virtuous.

Team. Team work is perhaps the single most important factor contributing to the success of a distance education endeavor. Teachers, students, staff, administration, technicians, site facilitators, vendors, production personnel, aides, instructional designers, and a variety of other people must coordinate efforts and share expertise in order to establish and maintain successful distance education programs. Wise distance teachers will be team players and will know that they can not be successful without the help of others.

Update. Technologies change. Teaching methods change. Instructional media and materials change. Students characteristics change. Course goals change. Wise distance teachers consistently update their knowledge of and expertise using distance delivery systems and modify their distance offerings to meet changing instructional demands.

Philosophy. Distance teachers frequently have formulated a philosophy of education that is reflected by their classroom style and teaching strategies. Distance education courses can be delivered using traditional lecture formats dominated by teacher talk or can be designed to reflect the perspective that teachers are facilitators, coaches, and mentors. Wise distance teachers recognize the aspects of their teaching philosophies that will translate well using distance delivery systems and then work with other members of the distance education team to make sure the delivery systems are used effectively to support their philosophy and style of teaching.

Humor. Even the most prepared distance teachers using the most reliable equipment supported by the most appropriate human, financial, and physical resources will have a bad day when something, if not everything, goes wrong. Wise distance teachers will maintain a sense of humor and perspective and will encourage their students and colleagues to do likewise.

Pshaw! Regardless of the teacher's skill, the distance program's effectiveness, and the participants' good humor, distance teachers may find themselves in situations where a four-letter expletive may be both appropriate and therapeutic. In those moments, wise distance teachers will rely instead on this exclamation of impatience, disapproval, irritation, or disbelief.

Optimistic. Engaging in distance teaching and learning is a continuing challenge that requires time and commitment. Learning the limitations of delivery systems, translating successful face-to-face lessons into distance contexts, and dealing with instructional and non-instructional student problems are just a few of the challenges of distance teaching. Wise distance teachers will remain optimistic about the opportunities distance education offers to their students and will value the opportunities for their own personal and professional growth.

Though this is the end of the Greek alphabet, this is not the end of the strategies that distance educators can incorporate into their teaching. Wise distance educators will continue to try new ideas, overcome new challenges, and devise new approaches to teaching at a distance. As distance education opportunities expand to influence increasing numbers of educators and educational consumers, entries are constantly added to this lexicon.

References

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Keegan, D. (1990). *Foundations of distance education*. New York: Routledge.

U.S. Congress, Office of Technology Assessment. (1989, November). *Linking for learning: A new course for education*, OTA-SET-430 Washington, DC: U.S. Government Printing Office.

AN INTERDISCIPLINARY APPROACH TO CONCEPT DEVELOPMENT FOR INTERACTIVE VIDEO COMMUNICATION SYSTEMS

by
Susan King Roth

New technologies are changing the way we communicate, learn, and teach. In Winter of 1993 a design research project was conducted in the Department of Industrial Design at The Ohio State University by interdisciplinary teams of graduate students from Industrial Design, Industrial Systems and Engineering, Marketing, and Communication. The objective of the course was to allow students with diverse backgrounds to apply knowledge from their respective areas to the development of concepts through team methods. The project, sponsored by Thomson Consumer Electronics and Indiana Bell, involved the development of future applications for interactive video communication systems. This area of research is enormously active at the present time with telephone and cable companies, electronics firms, film and television production companies, computer hardware and software companies, and others, trying to assure that they will not be left out of what promises to the be the next great wave of economic and technological development.

The original intent of the course was to focus on human factors in the design process. Because of the scope of the project and the exploratory interests of the sponsors, however, a longer time than expected was spent in the discovery phase (searching for useful and relevant application areas) than in the design phase. Extensive readings were assigned to students (and instructors) in order that participants from all disciplines *get up to speed* with the latest information on electronic communication technologies.

Emphasis was placed throughout the course on the importance of working in interdisciplinary teams. Team members evaluated each other at midterm and at the conclusion of the course and this information contributed to each student's final grade.

There was extensive communication with the sponsoring organizations in Indiana. Three videoconferences and two face-to-face meetings took place over a ten-week quarter. The sponsors freely gave the student teams information and feedback, but very little direction. Their purpose was exploratory.

The course was taught by co-instructors Susan King Roth, Assistant Professor of Visual Communication Design in the Department of Industrial Design at OSU, and Dr. Elizabeth B.N. Sanders, Vice President for Research and Strategies at Fitch, Inc., an international design firm.

Guest lecturers were invited from other departments to complement the background of the instructors. These guests included Dr. Steven Acker from the Department of Communication, and Dr. Dave Woods from Cognitive Engineering discussed human factors research methods. John McClusky from the Department of Industrial and Systems Engineering discussed team formation.

Course Structure

The course was structured around periodic scheduled meetings with the sponsors in the form of face-to-face meetings, videoconferencing sessions, and e-mail communications via computer. The instructors developed a calendar at the beginning of the quarter that included key meeting points and other events as they should occur in sequence to assist the

problem-solving process.

We were fortunate to have extensive access to videoconferencing facilities at Ohio Bell headquarters in Columbus (through arrangement with Indiana Bell), so that we were able to use the same live, interactive video technology that was also the subject of the course, thereby becoming aware of the advantages and disadvantages of communicating and collaborating in this way.

Students located at the Ohio Bell videoconference facility seated before the camera and television monitor unit that transmitted and received communications from Indiana and Columbus. A second camera overhead transmitted graphics.

Team Formation

Nineteen graduate students from four different academic departments participated in the class. Students were solicited from Business (MBA/Technology Management) Communication, Industrial and Systems Engineering, and Industrial Design. All of the class meetings, videoconferences, and presentations were videotaped by a Communication student. Another student from Communication provided a meta-analysis of the course, working teams, and group dynamics incorporating information related to collaborative research projects into her thesis study. All students were pursuing graduate degrees in their respective departments; many were mature with previous professional experience, and the represented various cultures and ethnic backgrounds.

The first step in team formation required that the students share information about themselves by filling out a short questionnaire. This information was used to form three preliminary research teams balanced in terms of department, age, sex, and country of origin.

Each of the teams selected a content area in which to conduct research for the first four weeks of the quarter.

The goal of the research teams was to gain an in-depth understanding of the preliminary area of focus (either society, technology, or individual/group) and to explore opportunities for future applications of interactive video technologies. At midterm, the research teams presented their understanding of the problem space and ideas for applications as well as desirable attributes for the communication systems.

New teams were formed after the midterm presentation. Four concept or design teams were formed by balancing discipline and research focus. Minor adjustments were made due to personality factors that emerged in the first set of teams.

Project Groups

The assignment of projects to the four design teams was a highly collaborative process. Selection of the project areas was done in a face-to-face work session following the midterm presentation. Present at the work session were students, instructors, sponsors, and several outside guests with an interest in the subject.

Research team members were responsible for submitting index cards describing potential applications that emerged during the course of their preliminary studies and discussions. Over 70 ideas were offered as a result of brainstorming. Closely related ideas were placed in the same category, resulting in 16 separate categories. With guidance from the sponsors, four very distinct

project areas were chosen. These four areas were:

1. Remote Troubleshooting/ Diagnostics (on the scene access to experts).

2. VolksVision (personal applications of video and electronic technology).

3. Education (K-12, higher education, continuing education).

4. Town Hall (political and social group interaction).

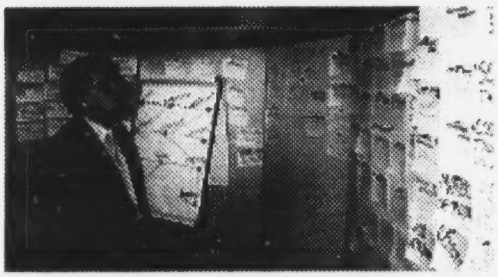
Assignment of projects to design teams took place the following week. We assigned project areas randomly by drawing student names when some of the project areas proved more *popular* than others. This resulted in an equal distribution of students to all areas.

Each team was responsible for developing concepts in the project area assigned and presenting results in the form of a preliminary and final presentation to the sponsors and the class. Each was to produce a written document as well.

Evaluation

Students were evaluated on the results of their teamwork (60% of the grade) as well as their performance as team members (40%). Results of their teamwork were shown in a preliminary presentation via videoconference facilities and in the final presentation (a face-to-face meeting). The final presentation used a variety of media such as slides, video, and computer-generated interface designs to demonstrate proposed applications. Written reports included:

- a problem statement
- technological underpinnings
- market analysis and planning
- user research
- product/service embodiments
- recommendations to Thomson-Indiana Bell.



Cards representing 70 ideas generated during a brainstorming session were placed on the wall in order to establish categories of ideas on a Concept Location Matrix. A separate *attributes* section describing desirable attributes was also created, with cards copied and distributed to each of the four concept groups. Combining ideas with attributes resulted in further concept generation and definition.

Participants from the Department of Communication played a significant role in the evaluation of existing applications, with one of the highlights of the course being the lecture by Dr. Steven Acker on eye contact and the effect of image size and other factors on acceptance of videocommunication as a reasonable substitute for face-to-face communication. Communication students brought a knowledge of media and public policy to the teams.

Students presented extensive research reports during the final presentation, with Business students supplying the marketing plan, while Design students produced visualizations (concept sketches and computer-based interface designs) for products and systems developed by the teams. All members of the teams supplied concepts and participated in brainstorming sessions.

Because of the experimental nature of the course, it was important that students be given a means of evaluating the course and the instruction. The form used for this purpose provided feedback that encouraged us to continue with future endeavors.

The course was extremely successful in terms of the outcome--the research

reports were outstanding. It also provided a real-life experience with a *fuzzy* design problem (one without clearly defined parameters) and important experience working in interdisciplinary teams. There were a few negative aspects of teamwork, such as the fact that one team had fewer members due to unforeseeable circumstances and did not benefit from equal contributions by remaining team members. In the future, team dynamics will be more carefully considered and controlled. Rather than expecting a leader to *emerge* naturally, as had been predicted by students from the MBA management area, it would be preferable to assign a team coordinator or facilitator to assure progress and direction in the future.

Also, we would extend the amount of time available for this course to two quarters, or at least more than the usual ten week quarter. We hope to develop other collaborative sponsored research projects building on the strength of this experience, the wealth of *brainpower* in a variety of disciplines existing on campus, and the need to present opportunities for both graduate and undergraduate students to work on interdisciplinary teams. Additional time should ideally be devoted to testing proposed applications with user groups, and incorporating feedback into the design of new user interfaces. The most difficult aspect of predicting user reaction to new applications of technology is the inability of users to visualize or imagine how these technologies might be used. Prototypes facilitate visualization.

The key to acceptance for any new communication or information technology is attention to the human use of the system. For this reason, many of the concepts were based on needs and wants of potential users, with consideration of social and cultural factors surrounding the production and consumption of communication technologies.

In terms of project development, the design of applications for new technologies presents a challenge that involves more than one content area. It is very important to acknowledge that one person (or discipline) can not possibility know all there is to know about designing such a system or product, but must understand when to call in experts in a given area to produce the best solution.

Consistent with the project goal of developing future applications for new technologies was the finding that the use of e-mail and videoconferencing to communicate greatly enhanced management of the course. The ability to distribute timely information to students and receive their questions and comments through e-mail, and to use video conferencing to communicate with sponsors in another state facilitated progress of the course and contributed to the successful completion of the design research project.

Assigned Reading for the Course

The following reading list was supplemented by current related articles from the media and research journals:

Acker, S., & Levitt, S. (1987). Designing videoconference facilities

for improved eye contact. *Journal of Broadcasting and Electronic Media, 31*(2), 181-191.

Bodker, S. (1991). *Through the interface. A human activity approach to user interface design.* Hillsdale, NJ: Lawrence Earlbaum Associates.

Chapter 6: User interface design: Advice to the designer, pp. 139-164.

Bretz, R. (1983). *Media for interactive communication.* London: Sage.

Part I: Some familiar interactive media systems, pp. 29-68 (television systems).

Part III: System design features: Issues and problems, pp. 167-263.

Compaine, B. (1988). *Issues in new information technology.* Cambridge, MA: Program on Information Resources Policy, Harvard University.

Chapter 1: Introduction: The information "revolution" is more than technology, pp. 1-14.

Chapter 5: Information technology and cultural change: Toward a new literacy, pp. 145-178.

Chapter 9: Contradictions and concerns, pp. 293-302.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry.* London: Sage.

Rosen, A. (1987). *Telecommunications.* San Diego: Harcourt Brace Jovanovich.

Chapter 8: Teleconferencing, pp. 183-196.

Chapter 10: The electronic home, pp. 220-241.

Schwartz, P. (1991). *The art of the long view.* New York: Doubleday-Currency.

Ulloth, D. (Ed.). (1992). *Communication technology.* Lanham, Maryland: University Press of America.

Chapter 2: Teleconferencing: A rapidly growing innovation, by L. Lappin, pp. 19-26.

Chapter 13: Interactive video: A learning tool, by R. Gould, pp. 137-144.

Chapter 14: Social effects of interactive video, by N. Greco, pp. 145-152.

Credits

This paper includes material developed by Susan King Roth, Associate Professor of Visual Communication Design, The Ohio State University, and Dr. Elizabeth Sanders, Fitch Inc., Co-instructors. A related article was published in the Winter 1994 issue of *Innovation*, journal of the Industrial Designers Association of America. The interdisciplinary project course was made possible by generous funding from Indiana Bell (Ameritech) and Thomson Consumer Electronics.

Photographs by Rich DiCenzo.

DESIGNING VISUAL METHODS OF COMMUNICATING VISUAL CONTENT WITH ART HISTORY SOFTWARE

by
Ellen Schiferl

Words vs. Images

Art history is a hybrid discipline that combines the verbal with the visual, yet verbal communication traditionally has defined the field. In class, students hear words and see slides but they take verbal notes and thus words become the basis for studying and understanding. Words dominate the scholarly approach to art history as well because academe can assess verbal publications more easily in tenure and promotion and because photos, particularly color photos, are expensive to reproduce. Unfortunately, words provide a limited vehicle for communicating visual ideas. Our eyes perceive an immense variety of colors, textures, and shapes that allow us to make an almost infinite number of visual distinctions that words cannot communicate. With a greater reliance on visual means to teach visual concepts, art history could be taught more effectively.

Paths to Visual Literacy

At the university level, art history courses, like studio and art education courses, play a vital role in communicating the importance of visual literacy, yet each art discipline defines visual literacy differently:

- Art appreciation and studio courses emphasize art terms and visual elements (Dondis, 1973).
- Art education focuses on perceptual and cognitive approaches (Arnheim, 1969; Gombrich, 1956).
- Art history currently stresses cultural values such as the significance of afterlife in Egypt or harmony in Japan.

My art history curriculum moves beyond cultural context toward an even more fundamental question: How do people in a particular culture perceive reality? Here *world view* becomes a perceptual concept. As an extension of the mind, our eyes construct the visible world for us. While the biological mechanism for perceiving images is common to human beings, these images are processed by selecting certain forms. The mind selects forms on the basis of their importance and thus the perception of reality interconnects with what a culture deems important. Art cannot reproduce the reality of the eye but it can reveal the visual emphasis and spatial logic of a particular society. Further, art functions as both a passive reflection of perceptual systems as well as an active agent in generating those systems. By studying the art of different cultures we gain a better understanding of different patterns of thought.

Software example

The interactive software example used in this essay, *Space: The Visual Frontier*, represents an intermediary step between the heavy dependence on words characteristic of current art history instruction and a more rigorous approach to communicating visual concepts through visual means which will be presented in the near future. In the *Visual Frontier* software, most screens are evenly divided between text and visuals, but in contrast to publications and slide lectures, many of the visuals include animated overlays and diagrams to relay concepts.

The program focuses on one of the most significant shifts in the history of representation globally, the development

of linear perspective in early fifteenth century Italy. Typically art historians teach linear perspective as an advanced method of representing the visible world that signaled an increased interest in the physical rather than spiritual environment. Today many North Americans regard linear perspective as realistic and more sophisticated than other methods of two dimensional representation. The program delves into the religious, economic, and scientific sources of linear perspective and the examples for this paper stem from the religious section featuring Bernardo Daddi's *Meeting at the Golden Gate* (14th century), Masaccio's *Trinity* (1420s), and Leonardo da Vinci's *Last Supper* (1490s).

After outlining some Medieval perspective techniques, such as hierarchical scale (Figure 4), the program shows how Christian art communicated spiritual content through spatial organization. The placement of images of God the Father, the Holy Spirit, Christ, the Virgin Mary, St. John the Evangelist, and the male and female donors follows established conventions for conveying the relative importance of each figure by aligning them according to the centric, vertical, and depth hierarchies (Figures 5-8). These visual hierarchies spurred the development of linear perspective (Figures 9-10) and explain why linear perspective flourished in religious images. Far from developing in opposition to Christian spirituality, linear perspective reinforced religious models.

Visual Restraint

Educational software should be visually appealing to the user but designers should exercise discipline to ensure that form does not interfere with content. The primary challenge in designing the *Visual Frontier* program was to keep the text, graphics, and background from competing with the illusionistic techniques of the paintings. However, completely flat graphics would appear dated in comparison to Macintosh system 7 icons. As the focal point of the program's content, Masaccio's *Trinity* determined the color harmonies for the entire program and buttons composed of six shades of gray presented a shallow three dimensional frame for easy recognition.

Visual Targeting

I began designing computer tutorials when I realized that computer animations would be more effective than waving my hand before a projected slide to make different points about the direction of the eye or the relationship of the figures. In the program, animated overlays serve a variety of purposes. The white oval in Figure 4 identifies key figures, the red lines reveal the spatial structure in Figures 6 and 7, and the orthogonal lines link the viewer's space to the projected space of the painting in Figure 10.

Image Manipulation

Slide comparisons, a standard technique of art history instruction, clarify the differences between two artists, themes, or cultures by juxtaposing images. In the *Visual Frontier*, transformation, rather than juxtaposition, reinforces the difference between Medieval and Renaissance approaches to space which students often find difficult to comprehend.

To dramatize the differences between the *hierarchical scale* of the Middle Ages (where the size of the object is determined by its importance, Figure 4) and the *hierarchical depth* of the Renaissance (where the size of the object is determined by its distance from the viewer, Figures 8 and 10), the program transforms the visual structure of the Renaissance painting into the visual structure of a Medieval artwork. The figures expand or shrink according to their spiritual significance and since the background no longer needs to be an extension of the viewer's space, it becomes a uniform gold field (Figures 11, 12). By transforming one visual logic system into another, students recognize the spatial order governing different representational approaches.

Kinevisual Testing

Computer programming allows the user to move an object form one place to another on the screen. With kinevisual interaction, the viewer can engage in the decision making process of the artist and appreciate the significance of the artist's choices. The example in Figure 3 represents one of the simplest applications of kinevisual testing and follows an animated diagram that replicates a Renaissance method for producing linear perspective. To connect this technique to Leonardo da Vinci's *Last Supper*, students view the painting, mentally determine the location of the vanishing point, and then manipulate the mouse to superimpose the red dot on the vanishing point. Depending on the student's action, the response varies from "You found it!" to "Close enough!" to "Please try again."

Student Responses

The *Visual Frontier* was tested and qualitatively evaluated in four different courses with three different instructors (Art History survey from Paleolithic through Medieval, Art History survey from Renaissance through the 20th century, Cross-cultural Perspectives in Art History, Renaissance Art). The evaluations served as a means to an end--a better program, rather than as a research tool for its own sake. Responses to the open ended questions improved subsequent versions of the program and provided insights into the value of computer based instruction (CBI).

In the first version, students complained that the structure returned users to the main menu at the end of each unit. While nonlinear approaches are often touted as a major advantage of CBI, students feared they would miss a section. As a result, later versions allowed students to move through the entire program using the forward arrow or select a particular section with pull down menus.

As expected, students responded favorably to the interactive and multimedia aspects of the program and saw CBI as an alternative to books rather than to the classroom. When asked specifically whether they would rather use a computer or a textbook, 68% preferred the computer, 9.5% preferred the textbook, and 23.5% wanted to use both, a surprising response for a student body composed of 85% non-traditional students with an average age of 26.

Sample comments from one class:

- I would rather use the computer. It, depending upon the program, forces you to make decisions as you go along. A book throws a list of questions at you typically at the end of the chapter.
- The computer made it much more interesting. The info broken up into sections made it a lot simpler to digest rather than sitting down with a whole text.
- The advantage to using a textbook is that you can do it anytime and anywhere. I felt like I had accomplished more using the computer. It was more interesting and fun.
- The computer is less hard on your eyes and you are a more active participant.
- The more senses used, the greater the learning--hearing, reading, and interacting with the computer are all valuable.
- To be honest, art history is not my favorite subject to study. Using the computer program, I got to take a more active part in the learning and it makes the material more exciting for me. Using sight, sound, and touch to learn has a lot of advantages--it keeps you focused *a lot* longer.
- Yes, the moving visual displays

convey the point much easier.

- I like being actively involved in. . . seeing things move as demonstrations. So many times when you read a book the illustrations are barely skimmed over; on the computer you can't help but see the point being made and you can't help but learn because you are involved actively.

- I like the action part of the program. It added a bit of life to the assignment. I was curious to see what would happen.

Challenge for the Future

Computer programs provide one route to developing more visually direct methods of teaching art history. As visual media, computer technologies stimulate new ways of communicating concepts and we have only glimpsed their potential for new approaches to instruction. One of the major challenges for instructional software designers is to create programs that stretch beyond the distillation of information and the appeal of multimedia presentation to a more comprehensive approach that stimulates another level of thinking. As an intermediary step, the *Visual Frontier* demonstrates more visually oriented pedagogical tools but the ultimate goal is a new level of visual thinking for the discipline of art history. By reshaping the art history curriculum toward more visually oriented methods of communicating visual content, students will receive a clearer message about the significance of the visual knowledge.

Credits

The following have all been reproduced courtesy of Art Resource, Inc.:

Bernardo Daddi, *Meeting at the Golden Gate*, predella panel from *Madonna and Child with Saints* polyptych (Florence, Uffizi), tempera on wood.

Masaccio. *Trinity*. (Florence, Sta. Maria Novella), fresco.

Leonardo da Vinci. *Last Supper*. (Milan, Sta. Maria delle Grazie, refectory), fresco.

References

Arnheim, R. (1969). *Visual thinking*. Berkeley, CA: University of California Press.

Dondis, D. (1973). *A primer of visual literacy*. Cambridge, MA: Massachusetts Institute of Technology Press.

Gombrich, E. (1960). *Art and illusion. A study in the psychology of pictorial representation*. Princeton, NJ: Princeton University Press. (reprint: 1989)

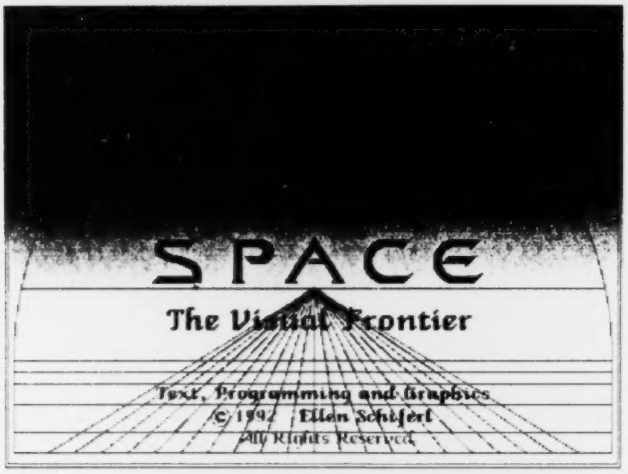


figure 1

Software:	**Space: The Visual Frontier. Linear Perspective.**
Author:	Ellen Schiferl, University of Southern Maine
Format:	One 1.4 M floppy disk including program, sound, images.
Computer:	Macintosh with 8 bit color, 13" or larger screen.
Level:	Advanced high school or university.
Contents:	Who/When/Where: Historical background
	What: Perspective methods defined with animations
	Why: Religious, economic and scientific context
Features:	Animated diagrams and overlays explain key concepts. Sound: music interludes and pronunciation of names.

figure 2

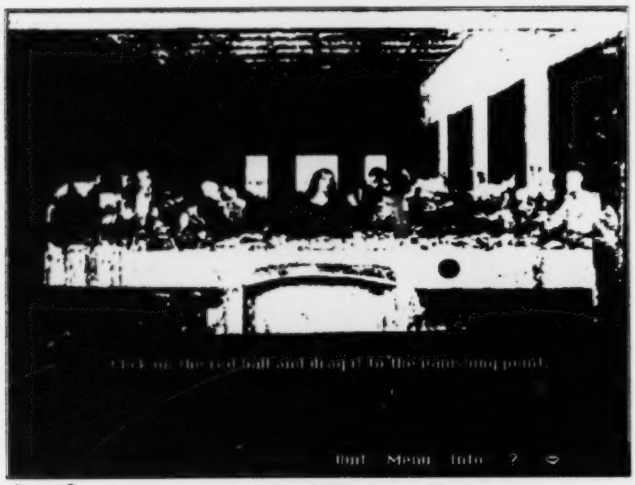


figure 3

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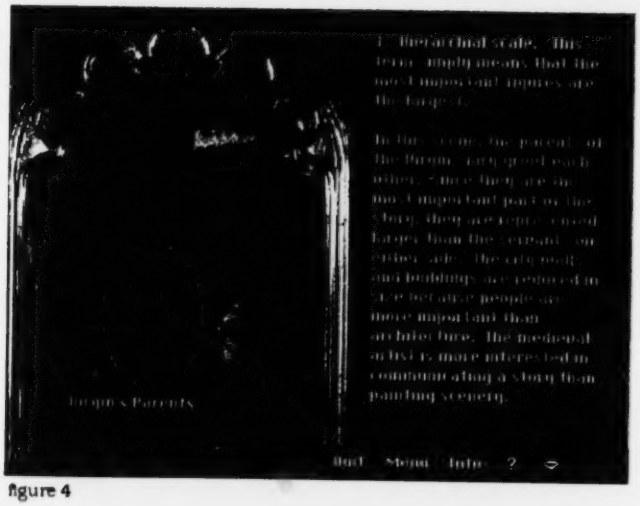

figure 4

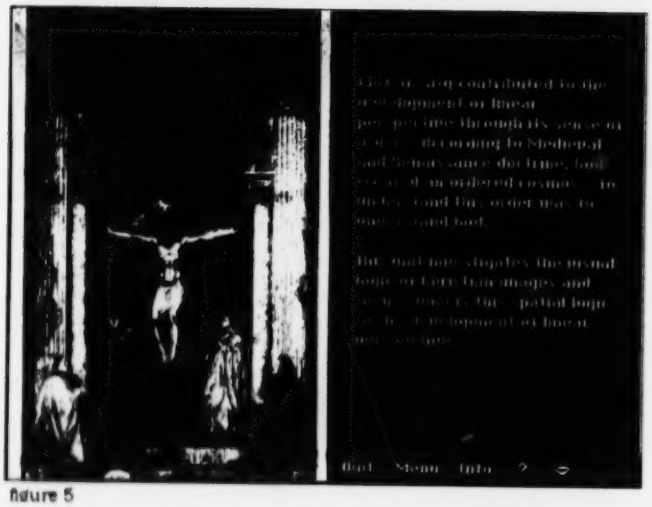

figure 5

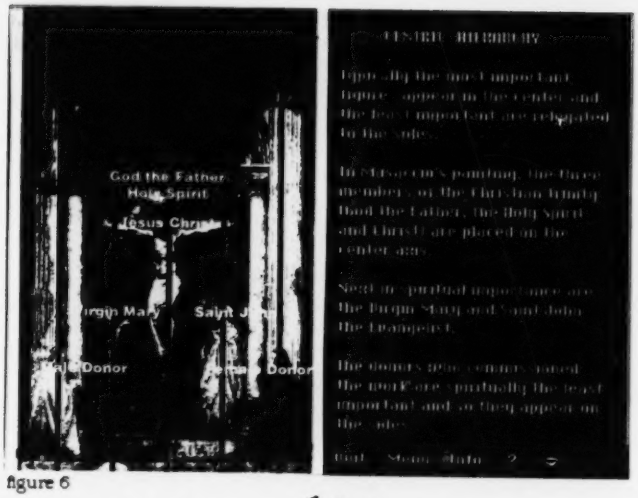

figure 6

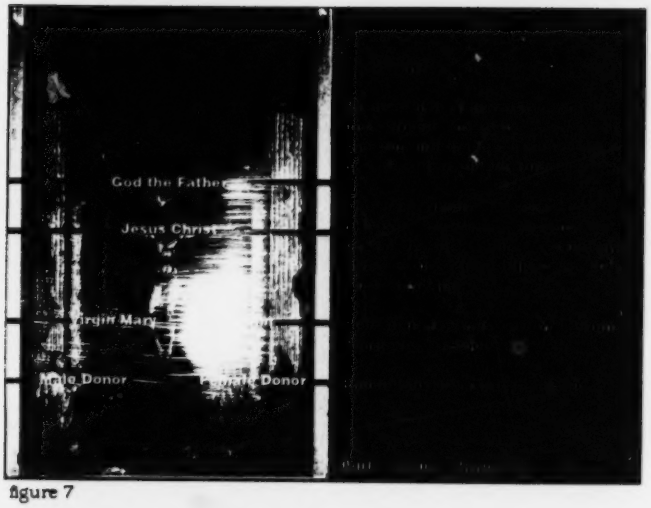

figure 7

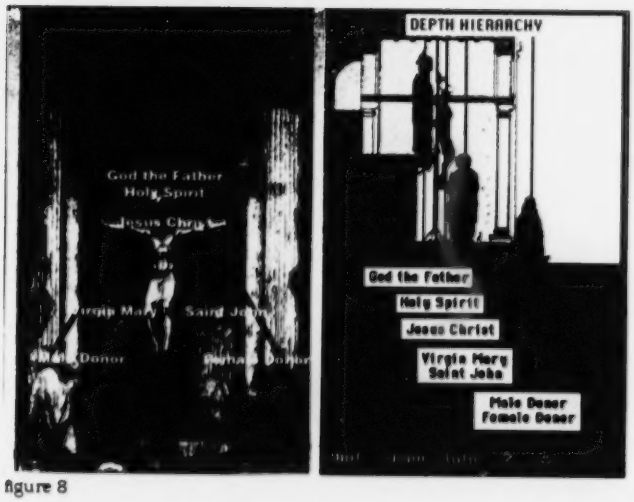

figure 8

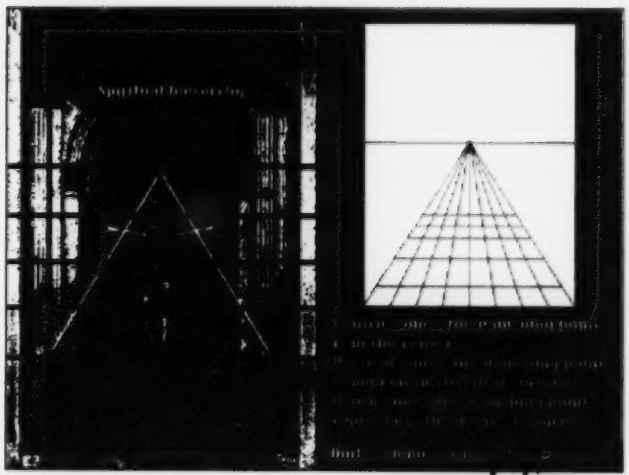

figure 9

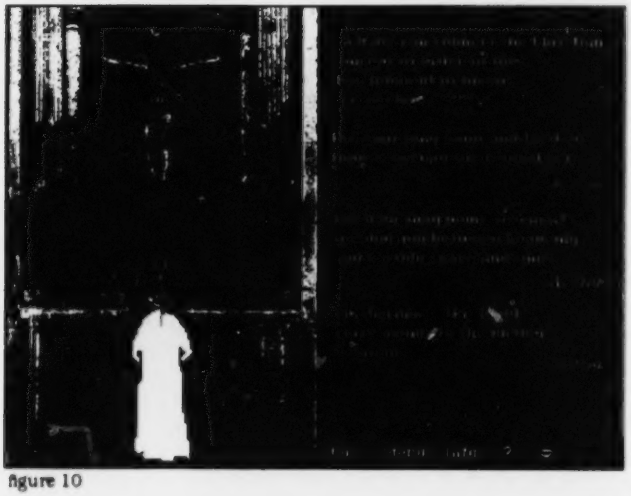

figure 10

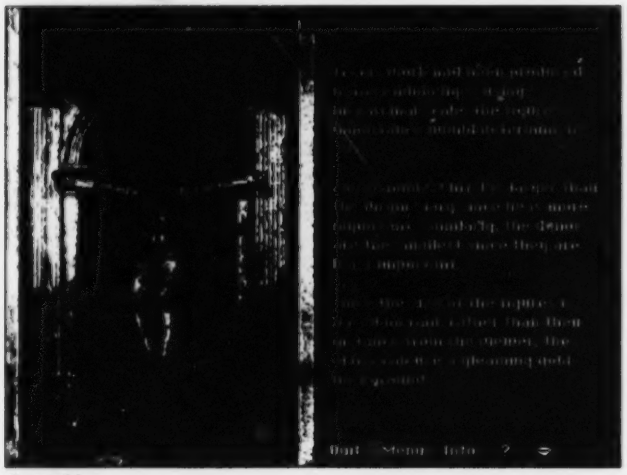

figure 11

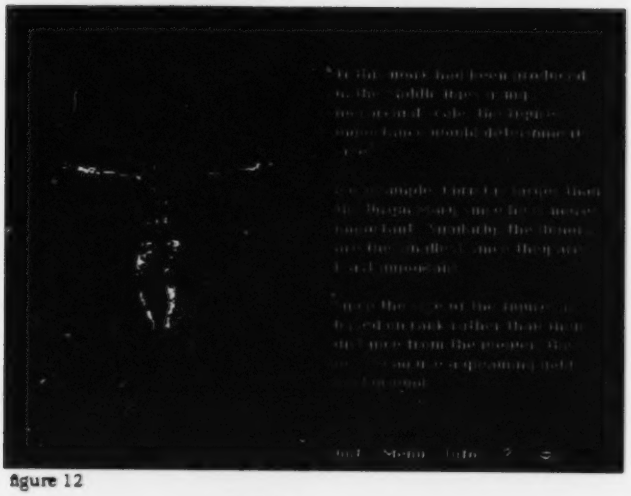

figure 12

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THE MODEL TECHNOLOGY SCHOOL: TOWARD LITERACY THROUGH TECHNOLOGY

by
Raymond J. Schneider

In 1985, the Florida Model School Consortia Act addressed strengthening the public school system by establishing prototype technology throughout the state. The Model Technology Schools (MTS) program was set up 'to research and demonstrate the effective use of technology in instructional deliver and enhancement.' Literacy is a strong focus area in the five model schools.

Literature has long been the favored tool of literacy--familiarity with the classic texts of a culture, its crafted expression of feeling, thought, imagery, and language style shapes the aesthetics and ethos of the culture wherein it lives. Of all literature, poetry most appropriately preserves the themes and forms of cultural expression. Yet, through a lack of understanding and appreciation, poetry has become a marginalized, even endangered, subject in English education today.

I propose a poetry curriculum structured with increasing complexity for K-12. Student understanding and appreciation of poetry will be enhanced through the medium of performance, made immediately accessible via laserdisc technology. The laserdisc performances will allow sound, music, and dance into the figures and the forms of poetry. This will pull poetry out of its traditional print bias and into the verbo-visual tech culture where it belongs.

The Florida Model School Consortia Act

In 1985, the Florida Legislature passed the Florida Model School Consortia Act (228.0855 Florida Statutes) to strengthen the public school system by establishing prototype technology throughout Florida (UCF/DOE, 1992):

> Their mission is to experiment and conduct research on how educational technology can be most efficiently and effectively incorporated into the public schools. The initial goal was to learn how to use technology to best prepare students to adapt to the rapid changes in society brought about by the infusion of technology in all facets of life. At the same time, the project should discover how to prepare teachers to incorporate technology into their teaching, learning, and management functions. (pp. 20-31)

Schools throughout Florida were invited to submit proposals to meet the objectives of the new statute. The Model Technology Schools (MTS) Consortium Committee selected five schools (two elementary and three secondary) for inclusion in the project. An MTS Facilitator was funded for each of these schools to oversee the ongoing school project and serve as a resource person for all school personnel.

Webster Elementary Model Technology Pilot Program

Webster Elementary School (K-5) in St. Augustine was the smallest of the five schools chosen for the MTS pilot program. A committee of public school administrators, university consultants, and local business partners had worked with the Webster principal, teachers, and parents to develop a concrete plan for their 5-year model technology grant program. All Webster teachers were asked to identify specific ways technology could enhance their class preparation and instructional presentation, and to suggest specific software which could meet their needs. Many of the teachers' suggestions

were incorporated into the successful grant proposal which emphasized teacher training.

The 1988-89 Planning Year

Initially, there was some resistance to implementation of the MTS program at Webster, so teachers were given the opportunity to transfer out. None did so. In-service training began during the initial planning year; every member of the Webster staff (instructional and non-instructional) took part in the program. The technology they worked with included CD-ROM, interactive video, laser videodiscs, video recorders, computer hardware, and several different software applications. Teachers earned in-service credit, released time, and limited stipends as incentives to participate actively in the program. By the end of the 1988-89 school year, each teacher had logged over 40 in-service training hours.

Under the guiding principle that curriculum should drive the technology, the teachers developed a list of *hard to teach* areas, by grade and subject matter, and began to identify specific technology to facilitate instruction in these areas. Hardware and software were prioritized and purchased as the MTS grant money became available. Teachers were encouraged to check out equipment and software for home practice.

The Implementation Years

During the 1989-90 school year, in-service training continued two days a week, with an additional focus--hands-on student involvement with the new technology. At the end of the school year, Webster students produced a videotape to illustrate this new involvement.

In 1990-91, an Apple-Share network was installed throughout the school. The teachers chose Macintosh workstations as most suited to their needs and computer skills. Cabling was run simultaneously for this network of teacher workstations, as well as the classroom phone lines and closed circuit television system planned for later stages in the grant. This was a difficult and expensive process, given the cement block construction of the original (1959) building and the presence of fire walls throughout (Eason, 1992).

The Apple Share LAN has been useful for sharing information such as worksheets or project notes with other teachers. As an additional incentive to teacher involvement, all communications from the school administration are sent via electronic mail. The network is also used in teacher-parent communication. Parents can dial into the Teacher's voice mailbox 24 hours a day to learn what is going on in the classroom, the weekly spelling list, field trips that are planned, etc. According to Webster MTS Facilitator Cathy Hutchins (Schneider, 1993), this networking brings down the walls between the classrooms and encourages teacher-sharing even across grade levels. However, Webster has already outgrown this limited access network.

Within the 93-94 school year, Webster will upgrade to a multi-use Novell network with on-line classroom access to the school media center. Recognizing that the idea of an individual classroom workstation for each student is not financially feasible, the goal at Webster is to have five networked workstations in each classroom.

Active Learning

All technology is geared toward active student learning by individuals or in small groups. This goal was based on observation of students in the IBM and Apple labs and at the five Macintosh workstations currently set up in the school Media Center.

Use of the new technology is especially evident in the kindergarten and first grade classrooms, where interactive software packages are replacing the basal readers. The software monitors individual student progress and builds the cumulative student record. This frees the classroom

teacher to work with individuals or small groups as needed. *Expert* students are identified and given extra media access so they can be an in-class resource to fellow students.

At Webster, there is little student enthusiasm for the old-style handwritten research report, especially in the area of science. Students are encouraged to use the computer as a word processor. Their final reports are output on one of the three laser printers that are part of the system.

For classroom presentations, students access slides and videodiscs, sequencing the media segments, adding titles, and incorporating these visuals into their oral reports. Thus, modern technology actually encourages student creativity and imagination. Students at the media center workstations build programs, save to a videotape, and then modify as needed to show in their classrooms. The Media Center is currently experimenting with CDI (Compact Disc Interactive), where the program is developed at the workstation and written onto a CD using a mouse.

In much the same way, teachers use scanned original art or purchased image banks to build instruction modules for presentation to the whole class, small target groups, or even individual students.

The new multi-user network with five classroom workstations will greatly facilitate student and teacher access to all available media. Slides, film strips, laser discs, video tapes, and other resources are currently being catalogued on an automated library system for classroom use.

The Hypercard software originally purchased proved to be very difficult for many teachers to learn since it requires programming knowledge. However, the Media Specialist and seven of the *expert* teachers have programmed Hypercard stacks and made these programs available to other teachers. The new Hyperstudio software is much faster and more user-friendly for the media novice who is assembling a classroom presentation.

Closed Circuit Television

In January of this year, Webster's closed circuit television studio became operational, complete with two commercial Panasonic cameras, line and camera monitors, and a switcher. Grades 3 and 4 produce the daily news show. Students in grades 1 and 2 handle the weather and features, respectively.

Project Evaluation

One key component of the Florida MTS project was ongoing research and evaluation within each model school, which would be shared with schools throughout the state. Ongoing research projects at Webster include surveys of use of the technology by teachers both in-school and out-of-school. Although all the technology was made available, teachers were encouraged to use the equipment they felt best met their own instructional goals and needs. Survey data indicate an average use of 1.97 hours per day for each of the 43 participating teachers.

Teachers were asked to complete reports indicating how the new technology has changed their instructional methods. Their comments included the following:

1. More emphasis on writing skills/word processing.

2. Variety of presentational methods.

3. More hands-on student activity.

4. Increased opportunity for working with individual students.

5. More organized presentation of material.

6. Better classroom visuals (videodiscs).

Current surveys indicate that the teachers use the technology more for inter-teacher and teacher-parent communication and for improved record-keeping than they do for actual instruction. MTS Facilitator, Cathy Hutchins, estimates a 3-5 year learning curve for integrating technology into everyday classroom curricula (Schneider, 1993). However, as teachers' level of technological expertise increases, a corresponding increase in instructional use is anticipated.

Webster teachers have one day a month released time to plan the use of technology in their classrooms. Curriculum planning software has been installed at each teacher's workstation. A key part of the Webster MTS program has been early identification of expert teachers whose enthusiasm for and creative use of the new technology sets them apart. These expert teachers are sent to special training programs, and serve as in-school resources for their fellow teachers.

Long-term follow-up of student skill acquisition would be an ideal evaluation tool, but this has not been possible. Construction of two new schools in the district, and the resultant shift of students has left only 33 students at Webster of the 900 who were there during the initial year of the grant.

Literacy and Technology

Although literacy is a fundamental goal of the MTS program, much of the available software is designed for science and math. Literature has long been the favored tool of literacy--familiarity with the classic texts of a culture, its crafted expression of feeling, thought, imagery, and language style shapes the aesthetics and ethos of the culture wherein it lives.

Poetry and Culture

Of all literature, poetry most appropriately preserves the themes and forms of cultural expression. Thus, poetry celebrates and preserves the sensibility of each culture. American poetry comes up from the biblical sadness in the parallelism of African-American spirituals such as *Deep River* and *Go Down, Moses* and Blues poetry to the fearless free verse and industrial vigor of the American Midwest. America grew from the informal, blank verse of Robert Frost's New England to the small town free verse epitaphs of Edgar Lee Master's "Spoon River Anthology" (Masters, 1962), from the syncopated jazz poetry in the chants and ballads of Vachel Lindsay's tribute to the American dream to the militant elegies of the same dream by "Beat" poets Lawrence Ferlinghetti and Le Roi Jones.

Yet, through a lack of understanding and appreciation, poetry has become a marginalized, even endangered, subject of modern English curricula in American schools.

This author's immediate teaching contact with the students at three universities (Eastern Illinois University, University of Bridgeport, and University of South Florida) has reinforced the conviction that the figures and forms of poetry, and, consequently, the cultural themes found in poetry that make up the ethos of our country are seriously neglected at both the elementary and secondary levels of education.

The result is that much of the richer levels of national expression historically embedded in the language of poetry have yielded to the peripheral sound-and-sight bites of commercial television. Moreover, so much of lasting value that is offered on television is spectator-centered, prioritizing passive viewing.

Poetry and Active Learning

The presumption of technology-based education, such as the MTS program, is that any new knowledge and instruction would include an active learning component employing interactive television methodologies. While these practices are in place and ongoing in areas of science, geography, biology, and some

language arts, the introduction of poetry as an ingredient of language arts curriculum is rare.

For the past 30 years, the present author has been adapting and staging prose and poetry while teaching college students communication as performance. Recently (this past year), during a course in video performance, the idea of exploring how computer technology can make such performance more accessible to students emerged.

Poetry and the Video Medium

This course featured the American classic, "Spoon River Anthology," a series of 244 verse epitaphs, created by Edgar Lee Masters in 1915. This work gives voice to the characters of a small Midwestern town who are interlocked by fate (Masters, 1962).

The students in this course first took these short verse epitaphs and presented them directly as soliloquies to the camera. They gradually began to see that, though they had met the television requirement of intimate immediacy, they were still word-bound. In the imaginative autobiographies that the students created to give background to the characters, there was a heavy imbalance of verbal over visual discourse. Like so many television news programs and educational television today, they were preserving what was essentially a radio format.

With the cry, "Tell a vision!" the group moved to image sequence. Recognizing that MTV and television commercials held an *image bite* of slightly less than two seconds, the poems were reprocessed to fit a lyric flow of image changes that might be suitable to the video experience. To explore this new production concept the students focused on the introductory poem, "The Hill," (Masters, 1962, p. 23-24) that summarizes "Spoon River Anthology."

The class was divided into alternating production/talent and talent/production groups to come up with two separate video versions of that same introductory poem. The production groups when formed had creative authority, of course, over their respective talent group during the rehearsal and shooting process.

The outcome of this project was a leap forward in the success of this beginning class. The mutual engendering of creative solutions to image flow challenges kept the class at these projects through the 105-minute dinner break between the two scheduled class sessions.

Time and time again, they worked in the studio from 2:00 to 6:15. The resultant videotapes ably illustrate the success of this *active learning* process; the matched dissolves, superimpositions of ghost-like conversations among the dead town residents, drawing the face of the narrator through the tombstone image, embedding the tragic rites of final passage from out of the church hill, and so forth were some of their experimental imaging effects.

Toward a New Poetry Curriculum

This successful experience, with students handling the performance of poetry in a video format, suggests the possibility of such video *products* being used to make poetry more available and appreciated as an elementary educational tool. If the forms and figures of poetry, especially in the heightened and active forms of children's poetry, could be entered into by means of modern technology, elementary and secondary school students might involve themselves actively in the richest texts of their culture in an increasingly sophisticated curriculum. What I speak of is as old as Greek culture itself, where the oral text of Homer's epics were communally entered into at Panathenea (Bahn & Bahn, 1970).

Now, it became clear that poems as simple and profound as Robert Frost's "Stopping by Woods on a Snowy Evening" (1992, p. 133) or Lawrence Ferlinghetti's "Constantly Risking

Absurdity" (1992) could be brought to life through video performance by a group of young people in a choreographed chamber theatre format or by using the poem as vocal text under a series of visual images. Winter forest slides would make the experience of Frost's snowy evening more immediate, and images of circus acrobats might illustrate Ferlinghetti's experience of the personal dangers in risking the art of poetry.

Finally, it is then only a small step to having students in active learning projects assigned to find these images (whether still or moving) and assemble them to create their own evocation of what the poems mean to them in visual terms. Students, working individually or in groups, from their own level of sophistication, might search out the images to express the form and feeling as well as the actual poetic devices manifested in the poems, and share these poems with their fellow students, using technology.

Learning the forms and devices of poetry becomes a process of felt sensing. A line of anapests, for example, when used to describe the galloping of a giraffe in Nicolai Gumilev's (1957) poem of the same name can turn the line of verse into a vocal image. The line itself describes the giraffe thus:

He is KINGly and STRAIGHT and his
MOVEments inCREDibly LIGHT.

The linked string of two slack followed by one stressed syllable is deliberately designed to create the echoing sound of the hoof beats of the galloping giraffe. The teacher may explain this device by reading the line aloud or the students may chant the line with exaggerated emphasis on the stressed syllables. However, if the sight and sound of a film of an actual giraffe galloping as projected on a classroom television or computer screen can match the verse line, voice-recorded by a trained performer, the viewing student(s) can see and hear the reason for the device of the poet in so arranging the beat of his verse. The function of the anapest that moves the line is made immediately available: the rhythm becomes audio-visual.

To move from poetic form to figures of speech, another use of creative technology, would be to consider the same poet's use of the device of metaphor. To quote a later verse from the same poem,

I know that the ostriches witness a
wonderful sight

When at nightfall he hides in his
emerald cave.

Now the figure of speech, *emerald cave*, could be eminently clear to a third grade student simply by transforming a colored photograph of a cluster of emerald gems into the cluster of green-leafed branches in a low-hanging tree where the giraffe rests at night. This process of changing one computer image into another, called *morphing*, is well within the capability of current computer technology. The student, without the tedious necessity of defining the poetic device of metaphor, verbo-visually comprehends "seeing one thing in terms of another."

Onomatopoeia (words whose utterance mimics meaning) can be technologically exaggerated, for example, by increasing the volume in a film of snakes *hissing*, by audio/visual raindrops *plopping*, by a close-up of bees *buzzing*, or by a film of water *swishing* and *splashing* on the rocks. "Assonance and internal rhyme in Gwendolyn Brooks' (1962) "We Real Cool" can be made audio-visual by African-American syncopated dancers stretching the vowels and echoing the drums and cymbals at the end of each line of verse.

Finally, if a student should use the laserdisc and computer with Frost's poem, "Stopping by Woods on a Snowy Evening" (1992) she/he might prepare slides or photos of New England snow scenes with horse and sleigh, winter forest scenes, and starry skies outside a window

of a bedroom where a child sleeps. These pictures, found in magazines, newspapers, or art book illustrations, reinforce a presentation preparatory to a performance of the poem. The iambic *rhythm* (characteristic of Frost) and the *rhymes* in the line endings might be superscripted and underlined thus:

Whose woods these are I think I *know*.
His house is in the village *though*:
He will not see me stopping here
To watch his woods fill up with *snow*.

My little horse must think it *queer*
To stop without a farmhouse *near*
Between the woods and frozen lake
The darkest evening of the *year*.

He gives his harness bells a *shake*
To ask if there is some *mistake*.
The only other sound's the sweep
Of easy wind and downy *flake*.

The woods are lovely, dark and *deep*,
But I have promises to *keep*,
And miles to go before I *sleep*,
And miles to go before I *sleep*.

Advanced students might try to match the poem with one of their own, even counting the syllables (eight) in each line and then printing out both Frost's poem and their own on facing pages.

In summary, therefore, I propose a curriculum for teaching poetry in grades K-12 using laserdisc technology such as that in place at the Webster MTS. The series of lesson plans would facilitate increasing comprehension of the devices of poetry, but the curriculum base would be poems enriched by American values and experience.

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TELEVISION: STUFF OF DREAMS

by
Jon Baggaley

Abstract

Since the techniques of modern visual communication are continually evolving, visual literacy is not amenable to rigorous definition in the same manner as verbal literacy. The fluctuating effects of media, however, can be minutely observed by new data collection techniques which reveal patterns of audience response similar to those which C. G. Jung observed in his analyses of word association and dreaming. The technique is known as Continuous Response Movement or CRM.

The Conference presentation demonstrated, via an electronic audience response method known as Time-Scaling™, the second-by-second patterns which unite an audience in tacit consensus towards media presentations, and the unexpected differences which divide them. The points at which an audience shapes the meanings of a presentation--and is occasionally shaped by it--were illustrated. The current paper discusses the importance of television as a source of dynamic data about the individual and society, and the need for new forms of media communication which feed this information back to them. Examples are given of the author's uses of CRM in contrasting areas of management training and community development (with Canadian fishermen). The extent to which an audience can ever become 'verbo-visually literate' is discussed in terms of international efforts to educate the public about AIDS.

Introduction

Community groups concerned about the effects of the media in society frequently remind us that today's child spends more time in front of the television set than in the school classroom. On this basis they argue that television is a more overwhelming source of ideas, images, and diversion than any other medium. Media researchers commonly counter this position of extreme concern by pointing to the ways in which the images of television are interpreted according to the individual viewer's psychological predisposition. They too argue that television is a powerful modern force. However, they stress that its effects are typically to reinforce the attitudes and behavior to which the viewer is already inclined; and they find these effects, in their own right, to be a powerful source of information about audience uses and gratifications.

Curiously, one other stimulus source with comparable powers is nowadays greatly overlooked. When the television set is off and we the viewer are asleep, images and ideas continue to bombard us via the medium of the dream. The nightly parade of dreams can divert and disturb us with the vividness and spontaneity of a technicolor movie; and psychoanalysts, just like media analysts, have found the dream to be a rich source of information about those who experience it. Both analysts, doubtless without realizing it, even favour the same research techniques; and today's media analysts are using investigative methods which bear a remarkable similarity to approaches developed by the psychoanalyst Carl Gustav Jung 85 years ago. We may turn, therefore, to the work of Jung for insights into the directions that current media research is taking.

Continuous Response Measurement

In the *Journal of Abnormal Psychology* (1907), Jung reported his use of a sophisticated laboratory system of pulleys, weights, slides, and balances, built to measure the second-by-second reactions of his subjects to verbal stimuli.

From the information yielded by this highly precise measuring device, Jung developed insights into the individual psychological differences between his experimental subjects; and on that basis he devised the celebrated *word association* technique. Eighty years later, modern researchers are using similar second-by-second measurement principles in their studies of audience reactions to television. Today, their technique uses compact lap-top computer technology, and is known as *continuous response measurement* or CRM (Baggaley, 1986).

The CRM technique is relatively unknown outside the worlds of commercial and political advertising. Neither is apt to advertise or publish its approaches and findings, regarding them as trade secrets to be jealously guarded. But the powers and incisiveness of CRM are increasingly evident.

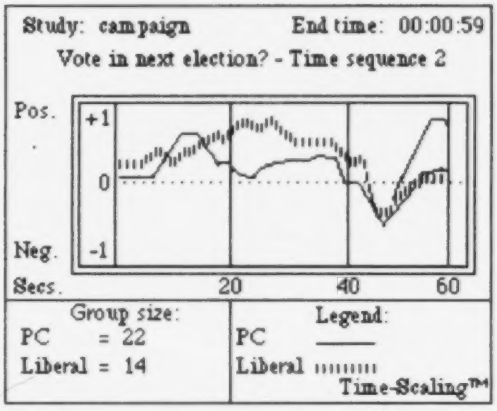

Figure 1. Voters' second-by-second responses to a television party political advertisement.

What, for example, do former US Presidents Reagan and Bush have in common with some of the most popular characters in children's television? Like the puppets of television's *Sesame Street*, their public images were monitored and refined following audience feedback collected via some sophisticated CRM research techniques. Figure 1 indicates the type of CRM data collected in the political research context.

The vertical axis in the Figure represents the average responses on a scale of approval (from positive to negative) to a television election campaign advertisement, given by supporters of two different Canadian political parties. The horizontal axis indicates the passage of time, second by second. Taken as a whole, the graph demonstrates how the viewer's responses fluctuated as a direct function of the moment-by-moment television stimulus. In the hands of party political researchers, the precise moments at which the audience responses become positive and negative can be charted on this basis, and used to advise campaign strategy. In the hands of commercial researchers, the same techniques are used to develop maximally persuasive television advertisements for beer and soap flakes.

Fortunately, the use of these incisive techniques is becoming increasingly familiar to television viewers, particularly in the media's political campaign coverage. After the 1991 Gulf War, for example, the crucial role of CRM was noted; and during the 1993 Australian national election, viewers of the television leader's debate on Channel Nine saw a simultaneous second-by-second reading of audience responses known popularly as the *white worm*.

CRM 'Behind Closed Doors'

From their innocent applications in the hands of Carl Jung, to their often Machiavellian uses in modern political research, CRM techniques have a far-reaching and to some extent frightening potential; and their quiet evolution in the North American television industry makes a fascinating story.

In early 1988, Vice-President George Bush was considered a long shot for the US Presidency. His position as second fiddle to Ronald Reagan represented a severe handicap to his election hopes; and compared to *the Great Communicator* his smiling image seemed wimpy and wan. Clearly some serious image-doctoring had to be done.

During the final months of the campaign, Bush underwent a metamorphosis. Gone was the quiet and diffident Bush: In its place was a tiger. A battery of opinion research techniques had supported the need for the new image. Question and answer techniques defined Bush's public image in the regular manner. In addition, his second-by-second appeal for television viewers was recorded on electronic hand-units via CRM.

The CRM method revealed parts of Bush's public image that other research techniques could not reach. The audiences' moment-by-moment reactions showed that they had particular respect for him at instants when he projected a tough-guy persona. In a real sense, their perceptions were subliminal, for only the researchers were in a position to recognize the patterns of opinion revealed by different viewing groups. The art of public pulse-feeling had reached a powerful new level.

At first blush, such methods sound unethical. Their association with secretive political research adds to that impression; and George Orwell would be proud to note that Republican advisors first used the second-by-second technique in their reelection bid of 1984.

However, the same approach has long since had a far more innocent application, in the development of some useful educational television shows, notably in New York and Toronto; and George Bush and the *Sesame Street* Big Bird owe CRM methods a similar debt of gratitude.

CRM In Education

The subliminal nature of CRM is a major reason for its political appeal. The most persuasive tactics in a person's bid for high office are often those which the public around him does not consciously recognize. But after ten years' work with these techniques in Canada, we have concluded that their potential benefits outweigh their abuses. We have used them in the development of educational films and television campaigns, to identify ways of communicating topics which audiences find difficult to discuss verbally. We have used them in communication skills workshops, providing teachers and executives with feedback on the aspects of their presentation which need improvement. As with any communication tool, the ethics of CRM obviously depend on the intentions behind its use.

During the '70s, for example, an unusually profitable relationship arose between producers and researchers at the Children's Television Workshop in New York. Together they devised some highly pragmatic ways of inspecting their young audiences' programming tastes. In conjunction with the Ontario Educational Communications Authority, a second-by-second response system was developed, providing more precise insights into children's perceptions than were available by regular question-and-answer methods. Although the CRM method was not new, the advent of the microcomputer in the late '70s streamlined it; and some of the most successful series in children's television (e.g., *Sesame Street* and *3-2-1 Contact)* were based upon its findings.

During the '80s, inevitably, CRM has found more lucrative markets. To advertising researchers, the method offers obvious benefits in the pilot-testing of television commercials. Since time is money in a 30-second television spot, every second must carry as much weight as possible. Moment-by-moment measurements of viewer's reactions indicate the specific points at which a television spot should be expanded or tightened. In this way the advertiser searches for ways of keeping his audience's attention remorselessly engaged. With modern computer facilities, CRM feedback can be instantaneous, allowing the evaluation to take place during the production process itself. On this basis, actors and camera crew can be briefed about the impact of shots they have just taped. A live television presenter can

even note viewers' responses to one sentence before moving on to the next!

CRM in the Training Industry

Particular uses of these techniques can be envisaged in the training industry. Management colleges, for example, spend appreciable sums of money to provide their executive clients with video feedback exercises dealing with interpersonal skills and the strategies of public performance. Yet, in terms of depth and precision, conventional feedback procedures languish in the Dark Ages compared with those used to sell soap flakes and US Presidents.

In a conventional video feedback session, a group of trainees is presented with an exercise (e.g., a debate, conference presentation, television interview takes, or a role-playing/simulation game). They carry it out individually or in small groups, and their progress is videotaped for subsequent analysis by the group and/or a specialist. Such exercises have been used since the '60s, to teach skills ranging from counselling and negotiating to trampolining and the golf swing.

A typical CRM session is based on a similar range of assignments, but automates the audience feedback process. As they watch the exercise, either live or taped, the group members record their moment-by-moment assessments of it on the hand-held keypads (Figure 2). The assessments may be given on any basis: interest value, clarity, persuasiveness, credibility, or any other relevant index. A computer-animated graph indicates the momentary high and low points in the sequence (as in Figure 1), and can be synchronized with the video record so that the reasons for second-by-second perceptions can be precisely identified.

These procedures obviate a common problem of traditional discussion situations: the inability of group members to achieve consensus and to level with one another. If a trainee public speaker has a distinctive speech pattern or a nervous tic, the participants in a face-to-face discussion may find it difficult to agree whether the trait is harmful to the trainee's impact--or even to mention it at all. CRM feedback, on the other hand, is clinical and anonymous. The implications of a nervous smile or fumble are evident in the immediate rise or fall of the audience responses whenever it occurs. Responses with no statistical are discounted by the analysis routines, and trainees readily acknowledge the detached authority of the computer display.

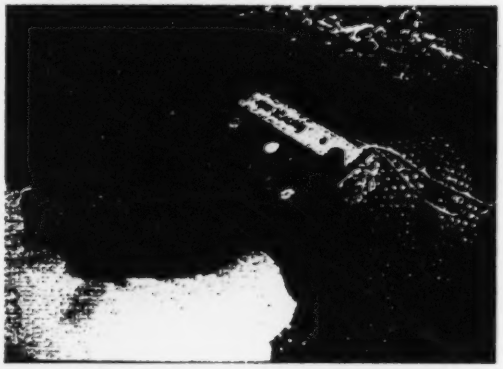

Figure 2. A CRM keypad used by a farmer's wife in a field on Mount Kenya to critique a pilot-test version of a radio agriculture program.

It is reassuring to note that these methods do not tend to breed the bland, stereotyped styles of communication encouraged by some training approaches. CRM's unusual sensitivity to nonverbal factors indicates that, in the right situation, an idiosyncratic, even tense style of communication can be a credible asset. With second-by-second precision, the CRM hand-units disclose that nothing impresses an audience more than *having something sincere to say*. The approach offers, in fact, an antidote to training procedures which yield an off-the-peg style of communication, and indicates that communication style without substance counts for little in the critical audience eye.

Just as Republicans Reagan and

Bush may have won their Presidential election campaigns by adjusting their personal styles, so their Democratic opponents may have lost them by failing to. In 1988 for example, while Bush turned tiger, Michael Dukakis strove to look relaxed, to look the television camera in the eye, and to look *presidential* in the JFK mould. While television comics lampooned his approach, Dukakis persisted in using a smooth, bland style which political analysts have debunked for years. The Dukakis policies may have been substantial, but his style did not help him to communicate them.

In future contexts, it is inevitable that strategic planners will seek to define the public mood more thoroughly than the Dukakis camp did in 1988. CRM methods will assist them in this, indicating accurate perceptions of public affairs as well as the public relations strategies via which they should be discussed. This possibility was illustrated in an unusual project in Atlantic Canada in 1982.

CRM and the Community

The Canadian seal harvest was under siege. The European Parliament had boycotted the seal pelt, and Atlantic fishermen were facing hard times. To help them maximize their dwindling income, the Federal Fisheries Ministry commissioned an educational film about pelting and storage techniques. In order to check whether the film needed any revision, its rough cut was pilot-tested in two fishing villages 400 miles from St. John's Newfoundland.

Eighty fishermen took part in the analysis. Their literacy levels were low, and normal questionnaire/interview methods were unlikely to be much help in probing their views. Group discussions were unlikely to elicit their unguarded opinions in view of the issue's extreme sensitivity.

Using CRM hand-units, however, many of the men responded nonverbally and anonymously to the film, with a decisiveness which surprised even themselves. The data were cross-referenced with further responses given after the film, and were fed back to the men for their own use. In the process, the men seemed to gain insights about the similarities and differences in their views which had not been apparent previously. The feedback sessions proved to be key events in a process of community development which led, within a year, to the formation of the Canadian Sealers' Association and to significant social change.

On other social fronts, the process of change takes a little longer. In Montreal we have been studying attempts since 1986 to inform the public about AIDS, and comparing the campaign styles with the greatest and least educational impact. CRM studies have revealed that audiences prefer simple, straightforward styles of information on health topics, and that, for example, florid or melodramatic elements are received negatively by viewers. Yet AIDS campaigns using a straightforward approach have often been withheld from the public on suspicion that they may have harmful effects. Meanwhile, many broadcast campaigns have used complex advertising techniques which CRM studies have shown to be inappropriate.

Clearly something in the management of these campaigns is awry. It may certainly be assumed that the divers styles used in AIDS education to date have been developed in good faith. But they cannot all be right; and it is highly probable that conventional market research methods are failing to define the actual psychological impact of public health promotion strategies with sufficient clarity.

Conclusions

If the studies discussed in this report are any guide, it is feasible that CRM methods can provide a quality of feedback about media effects which other research methods do not yield. Questionnaire and interview methods, administered before and after exposure to campaign materials,

may be quite incapable of eliciting the fine-tuned responses which CRM methods detect while the materials are being viewed. When the issue at hand is as sensitive as, for example, AIDS, the anonymity of CRM responses is also likely to increase their reliability.

Since the images and situations conveyed by the communications media are so varied and so permanently susceptible to change, it is possible that our efforts to understand their effects in terms of *verbo-visual literacy* skills may be too ambitious. In view of the vast range of individual differences in viewers' reactions to media, a more pragmatic approach, focussing on the second-by-second idiosyncrasies of the media consumer, may now be timely. It seems to be no coincidence, therefore, that modern media researchers are returning to the meticulous techniques used by C. G. Jung to examine individual psychological differences. Via this time-honored paradigm, modern researchers may find the effects of television to be a rich source of data about the individuals, just as psychoanalysts have found the dream to be a mine of information about the dreamer. The content, form, and effects of television may come to be regarded as indeed *the stuff that dreams are made on.*

Numerous contentious issues arise in society which this approach to communications research could be called upon to resolve. Health, the environment, trade: public campaigns are needed on each of these public agenda items, and their design strategies need immediate attention. Traditional communication research strategies certainly seem unreliable in dealing with them. (As this chapter is written, a Canadian television election advertisement, presumably based on the most up-to-date of conventional research methods, is having disastrous effects for the national political party which has sponsored it.) The new CRM techniques have shown that they can help in these areas by:

1. Sharpening discussion of issues, attitudes, and communication styles.

2. Revealing patterns of public opinion which would never be suspected normally.

3. Punctuating myths about communication practice which seemed unassailable.

4. Reassessing stock approaches to communications management which do not seem to be yielding results.

Such methods sometimes seem Machiavellian. Or maybe they are simply better at distinguishing the politics and style which the public wants from those it does not. Either way, we have seen to date that continuous response measurements of a person's communication style can help him to gain the most powerful executive office in the free world. Perhaps they can also help him to use it in the best possible way.

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INTELLIGENT ADVISOR SYSTEMS AND TRANSFER OF KNOWLEDGE

by
Marie-Michèle Boulet

Introduction

In Quebec, the teaching of music is regulated by the Quebec Ministry of Education. That corresponds to a mandatory music curriculum (Ministère de l'Éducation, 1981) divided into six modules: creation, execution, graphics, musical language, musical literature, and sound environment. This research concerns the creation module. The main objective of this module is to allow the transfer of knowledge of the musical language elements. Composing melodies is the activity proposed by the Ministry of Education (Ministère de l'Éducation, 1983). Therefore, in accordance with Burns (1988), the Ministry of Education considers that the creative process not only synthesizes previous learning but also elevates the mind into a higher stage of reasoning--the problem solving stage. Moreover, in accordance with Moore (1990), the tasks are conceived as "musical problem solving" within a context of implicit as well as explicit musical parameters (an incomplete melody). Figure 1 shows the variety of exercises proposed to students which correspond to musical composition activities proposed in "Musicontact 3," a book approved by the Quebec Ministry of Education (Fournier, Milot, Richard, Béchard, & De Melo, 1986).

The Technology

An intelligent advisor system is an instructional technology especially designed to further the transfer of knowledge. It is an adaptive system aimed at intervening when the user of any application software performs transfer tasks (Boulet, 1992). According to Leshin, Pollock, and Reigeluth (1992), transfer tasks have great variation from one performance to another. They cannot easily be broken down into steps because the activity varies each time the task is performed. To compose a melody is a transfer task.

An intelligent advisor system is a technology to be used after the initial learning of concepts, principles, and rules. It aims at providing individualized, fast, and detailed explanations and feedbacks. The intelligent advisor system MUSIC relates to the creation module of the grade 9 high school. Its purpose is to help a student while he or she uses a musical writing software to compose a melody.

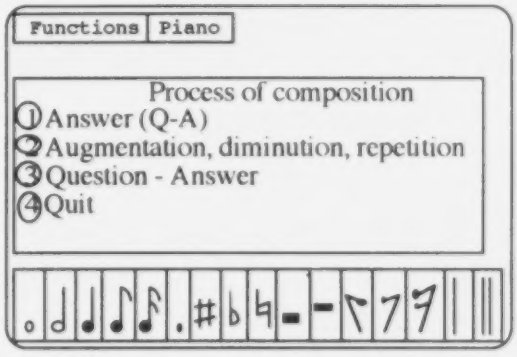

Figure 1. Activities Proposed

The Requirements

Ten years after the implementation of the music curriculum, many observed that the main objective of the creation module was not reached (Boulet, Dufour, & Lavoie, 1992; Fédération des Associations des Musiciens Éducateurs du Québec, 1990). Creation activities were not individualized, but group based. Students did not really transfer their own knowledge of the musical language elements. Consequently, we decided to develop the advisor system MUSIC.

The Advisor MUSIC

There are three types of instructional transactions:

1. Explanations requested by a student in regard to musical language elements.

2. Comments on the student's composition.

3. Comments on compositions made up by the advisor.

Type 1

When students perform exercises MUSIC can help them by presenting explanations on prerequisites. The ability to use the question/answer process of composition being considered, the analysis of the music curriculum, and specialized books allowed the identification of 67 prerequisites and 29 rules (Boulet, & Dufour, 1991; Boulet, Dufour, & Lavoie, 1991a, 1991b).

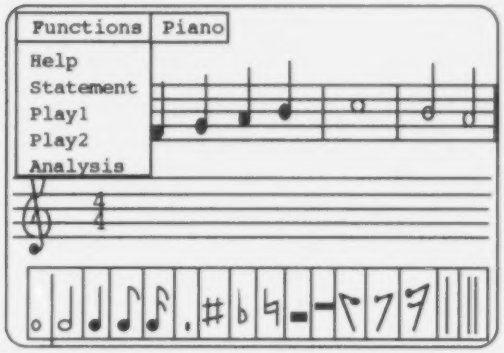

Figure 2. Functions Menu

For an explanation, the student merely selects the Help option in the menu Functions (Figure 2). The explanation requested is superimposed on the musical writing software (Figure 3).

As illustrated in Figure 3, there are underlined words within each explanation. They represent corresponding prerequisites. When a student clicks such a word with the mouse, the corresponding explanation is displayed.

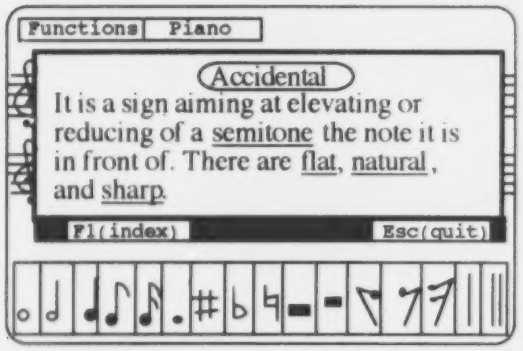
Functions
Piano
Accidental
It is a sign aiming at elevating or reducing of a semitone the note it is in front of. There are flat, natural, and sharp.
F1(index)
Esc(quit)

Figure 3. Explanation

The student can also see an index of all the explanations available, ask for one or more melodies related to a particular explanation, see a map of prerequisites, go back to the previous window, or go to the current composition activity.

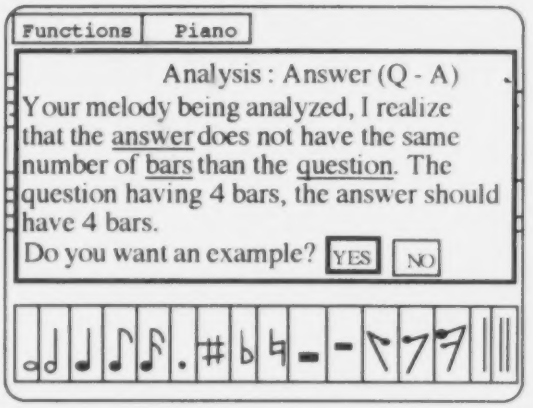
Functions
Piano
Analysis : Answer (Q - A)
Your melody being analyzed, I realize that the answer does not have the same number of bars than the question. The question having 4 bars, the answer should have 4 bars.
Do you want an example?
YES
NO

Figure 4: Commenting on Melody

Type 2

When a composition is completed, MUSIC can analyze it. Figure 4 presents an example. Here again, underlined words give access to prerequisites.

Type 3

MUSIC can also create a composition. If the student clicks on the "Yes" button illustrated in Figure 4, the advisor

composes. The advisor can also comment on its own composition. The comment will be similar to the one displayed to the student (Figure 4).

Purpose of the Study

The purpose of the study was to determine if the advisor favors the transfer of knowledge. Stated in the null form, the following hypothesis was tested:

Ho1. Students exposed to MUSIC will not show any significant improvement when transferring the knowledge of the musical language elements.

Procedures

Subjects

The subjects consisted of 27 voluntary ninth grade students from Quebec high schools (at the beginning there were 29; because of the attrition, only 27 completed the study).

Instruments

The validity and reliability of the test were established in two pilot studies (Boulet, Simard, Lavoie, & Dufour, 1991). 28 ninth grade students participated in the first. Results are summarized in Table 1. The Spearman Brown and KR_{20} both reached 0.9. We calculated factors of difficulty and discrimination and removed easy or non discriminant items. We reformulated certain items. The new version was tested on 51 ninth grade students. Results are summarized in Table 2. The Spearman Brown reached 0.9 and the KR_{20}, 0.8. Each item reached a satisfactory level of difficulty and of discrimination.

Results

For the pretest, the mean was 29.1%, with a standard deviation of 11.9. Results of the post test are the following: Mean = 66.2%, standard deviation = 14.5. A Two Group Paired t-Test was performed to verify the hypothesis: p = .00. Because the group realized a statistically significant improvement of the transfer of knowledge, the hypothesis was rejected.

Table 1
Pilot Studies Results

	Mean%	Std Dev	Spearman-Brown	KR20
1st	58.3	12.6	.9	.9
2nd	28	11	.9	.8

Discussion

Students improved the transfer of knowledge. We think that this result must be interpreted as the effect of the individualization. As mentioned before, music teachers have some problems with the creation module. Corresponding activities are rarely performed. Corresponding activities are not individualized. The advisor MUSIC does what is impossible for the human teacher of a class of thirty-three students, i.e., to perform concurrently the following tasks: for each learner's composition to generate adaptive, fast, individualized, detailed, remedial, and corrective explanations and feedbacks.

We also think that the way we implemented the advisor MUSIC had an influence on the results. We personally implemented MUSIC in its environment. Consequently, we were there to make sure that computers and technical features related would always be in order. We were there to make sure that the advisor will be used. Therefore, no technical problems interfered with the use of the advisor.

To conclude, we would like to recall that an advisor system does not aim at replacing formal teaching. It handles the issue of the transfer of knowledge. Other studies with different populations and different advisors will allow to learn more about the effectiveness of this particular kind of help.

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FROM TEXT TO TELEVISION: HERMENEUTIC TEXTUALISM AND THE CHALLENGE OF VISUAL TECHNOLOGY IN THE TEACHING OF HISTORY

by
Peter Knupfer

Just as the audiovisual revolution of the postwar period entirely rearranged the history and social studies classroom, so has the multimedia explosion of the 80s and 90s offered real temptations to the history teacher. Many of us old enough to remember the novelty of AV presentations--including educational films, ITV, and analog tape--are now intrigued at the exciting and promising ways that the television documentary or digitized imaging can help reconstruct and interpret the past. It is rare indeed to find the history teacher unfamiliar with audiovisual media, or who has not employed film, videotape, the transparency, or more recently, the computer, in his or her courses. But it is less common to observe the gap between the development of visual technology and its implementation in the history course. It is the purpose of this paper to suggest some reasons for this discrepancy and to raise some questions about how the multi-media revolution challenges those of us dedicated to sharing and transmitting the past to the present generation.

The challenge of visual technology to the historian and to the history teacher is of tremendous magnitude for the simple reason that the transformation of the human record means the transformation of history itself. Largely concerned with using the human record, historians, history teachers, and those entrusted with the care and preservation of the remains of our past, are understandably nervous about the pitfalls of electronic technologies. At the heart of this concern is what the profession prefers to call *the objectivity question*--the extent to which historians uncover the truth or merely talk about what they think to be true.[1]

The history of mass communications suggests that the manipulation of visual imagery can have as powerful an effect on human behavior as the manipulation of the written word. Recent warnings about a *hidden curriculum* incorporated in the use of instructional technology indicate that multimedia techniques will not escape the perennial controversy about the kinds of social values the schools are supposed in inculcate.[2] With the expansion of media technology one can trace the intensification of the controversy about hidden messages in the classroom because the very nature of the electronic medium is fluid, ephemeral, and increasingly responsive to the momentary demands of emotion and whim. If the awesome potential of visual technology heightens the importance of visual literacy, then it would be valuable to understand how the advocates of verbal literacy used the media of their day--especially the lowly schoolbook--to associate literacy with publicly-approved social values.

The teaching of history was a late comer to the common school curriculum. Until the middle of the nineteenth century, public education concentrated on training youth in reading, writing, and arithmetic. Verbal literacy and numeracy were considered the platform for an informed, industrious, *respectful* citizenry ready to participate in public life. The curriculum in the early public schools, therefore, stressed the mastery of language and numbers, usually through rote memorization and recitation of basic vocabulary and tables of numbers. Although educators occasionally incorporated historical themes in their teaching, they were too busy trying to control their unruly charges and to satisfy

the demand for fundamentals to offer systematic study in history.

As the common school reform movement of the 1830s demonstrated, however, this was hardly a morally or ideologically neutral agenda. The common school reform movement, led by such notables as Horace Mann and Henry Barnard, hitched literacy to civics and helped to bring history into the classroom. Careful studies of the common school curriculum and its mainstay, the textbook, have amply documented the nationalistic, ethnocentric, and moralistic message that it was designed to convey. The schools were to be the "pillars of the republic" and, like the family, the "nurseries of patriotism."[3] History textbooks appeared to meet the demand; the most popular ones went through dozens of editions and were still in use at the end of the century. As one influential text writer boasted, "it is from our *common school* histories, those unassuming companions of the school-room, and not from those more elaborate writings which grace the libraries of the mean of wealth and the professional scholar, that the great mass of our citizens must ever derive their knowledge of the character, toils, and privations of our fathers, and of the institutions."[4]

If patriots were made, not born, then the work was serious business indeed. Teachers, armed with a transformed pedagogy that now recognized childhood as a distinct phase of life, had a number of techniques at their command. They were instructed to take children out of the classroom to any suitable local scene associated with some unique historical event to stimulate and exhort students in the lessons of the past.[5] The very architecture and governance of the classroom were designed to transmit republican ideas. Monitorial pedagogy placed younger scholars under the direction of older ones and rewarded the mastery of lessons with advancement to positions of leadership. Where possible, teachers decorated the room with pictures of great leaders, nation and state flags, and maps of famous battles.[6]

The graphic arts could also be brought to bear. Text included woodcut engravings of the state seals, of famous leaders, of important events, and of religious and classical symbols that associated the progress of the nation with providential beneficence. George Washington's paternal visage greeted every young reader and beckoned him to national greatness through civic propriety and republican rectitude. Elaborate charts, and occasionally maps, tracked the acquisition of territory and the industrial and agricultural development of the country. Such visual imagery clearly and forcefully reinforced the basic message that the republican system was the only and the best system adapted to the American character, and that this way of life could self-destruct if students failed to place the public welfare above their own.

All of this is evident with even a cursory review of common school and popular history texts. Yet it is also clear that the ultimate emphasis of early history and civic training was the text itself: History teachers then, like their successors, were tied to texts. The most remarkable feature of early texts is the scarcity, and not the abundance, of illustrations. Early history textbooks greeted the young reader not with the dazzling illustrations common to modern textbooks, but page after page of small-print text punctuated by side bars and catechisms designed to induce complete mastery of the text. Oral and written recitation remained the standard exercise for history students.[7]

One survey of hundreds of secondary school texts across the entire century determined that only the science books--especially zoology, botany, and biology, with their emphasis on anatomy--innovated in any serious way in the incorporation of illustrations into the text.[8] Chromolithography had advanced far enough by the middle of the century to allow publishers to incorporate elaborate

colored plates, but rarely did these find their way into history books. Of the history and civics texts, most contained a frontispiece, a picture above the title of each chapter, and occasional drawings sprinkled through the book, but this constituted barely a fraction of the whole. Even the pictorial histories, written both for school children and general audiences, devoted but a tiny amount of their space to illustrations.

This is not to say that writers, publishers, teachers, or the public thought illustrations unnecessary. A few well-chosen and -executed illustrations can economically and powerfully convey a wealth of meanings without the confusion of interpretations fostered by a large number of pictures. Benson Lossing's (1857) *Pictorial Field-book of the Revolution* [9] demonstrated what the marriage of research and graphic creativity could accomplish. The research, writing, and indexing, plus the creating of exquisite 1100 engravings that graced every page took Lossing three years of tireless effort. Lossing wanted those illustrations to convey the actual modern condition of Revolutionary war sites--they were the forerunner of the photograph taken from Nature. The typical school text in the 1830s and 1840s on the other hand, shamelessly copied from existing works and could be compiled and published with a year. Lossing was an engraver--he eliminated the middle man and did the sketches and woodcuts himself, cutting his costs considerably. His school texts (about a dozen of the eighty-odd books to his credit at his death in 1891), were slap dash affairs, cut and pasted together with much less attention to illustration.

Certainly the public liked the graphic arts. Noah Webster's spelling book, first published in 1783 and designed to teach, through orthography and pronunciation, a written language, included woodcut engravings to illustrate its fables. When Webster eliminated the fables and illustrations from the new 1829 edition (in favor of disconnected, contextual *sentences* and word lists more like the modern-day spelling book), his public and publisher complained loudly.[10] Webster restored a few pictures, but stood by his belief that one learns a language by learning his letters. At that point, Will McGuffey's more carefully graded books, which taught children to read through lavishly illustrated stories about other children, captured the market for school primers.

A number of factors--current pedagogical theory, the architecture of the school room and governance of the school, the state of existing technology, the ideology of common school reformers, and the fragmented, disorganized condition of extant historical sources for illustrations--help explain the disproportion of verbal and visual material in early school texts. Some of these reasons are self evident, others obscure and complex, but all point toward an ideology of literacy and textuality that was at the heart of common school education in the prephotographic age. And none of them should hide the important point that illustrations, rather than convey information, were to convey a message about American life and the reader's place in it.

A schoolteacher in the early republic believed that a student learned more from reading words than from understanding pictures, charts, or maps. The latter form of education was simply a rudimentary step on the road to a higher state of knowledge and skill: the ability to interpret texts. Pictures--be they maps or sketches--were to serve texts, and not vice versa. To the teacher, the purpose of common school education was civic and moral training, and that meant mastery of a unique constitutional and political tradition founded on written texts. Words and their meaning dominated the curriculum of the nineteenth century common school.

The public square that future citizens were to inhabit was above all dominated by the sensationalizing newspaper editor

and the orating politician whose manipulation of language civics and history texts constantly warned against. As Michael Warner has pointed out in his interpretation of the period's "culture of print," mass communications invariably reinforced textual interpretation. Even though the quickened tempo of democratic political culture in the 1840s and 1850s featured public rituals (like parades, singing, and campaign placards) ornamented by the graphic arts, the very text of public discourse was texts, especially the constitution.[11]

As one civics writer put it in the preface to his 1823 civics manual, "the most effectual method of preserving our rights unimpaired, is to make them generally known and universally recognized; and the best mode of effecting this desideratum is to incorporate in the education of youth official documents containing their fundamental basis.[12] One did not teach the constitution, therefore, by sketching its structure of divided powers on a chalk slate. Instead, the student memorized the constitution, usually by practicing his handwriting with it, by reciting a constitutional catechism in class, and occasionally, by studying a chart comparing its provisions to those of the twenty-odd state constitutions.

Existing theory about hermeneutics, the science of textual interpretation, buttressed contemporary faith in textual literalism. Nineteenth century hermeneutics, unlike its post-modern version, emphasized that the author's intent determined the meaning of a text, and that although reasonable people might disagree over how to construe a text, its essential meaning remained unified and indivisible. Little wonder that constitutional literalism was of such tremendous importance to Americans that, like the theologians who originated the concept of hermeneutics, they cited chapter and verse of their constitutional Bible as the underlying reason for killing each other in unprecedented numbers in the Civil War.[13] Literacy, language, and law were intimately bound up in the country's civic consciousness, so that mastery of all became the defining characteristic of the young citizen. In the study of history the student was to see this philosophy teaching by example.

The emergence of mass media, accompanied by the individualization of readership, heralded the tremendous success of the common school literacy campaigns. As Carl Kaestle has pointed out, "the big story in nineteenth-century American literacy is the development of common-school systems and the near elimination of self-reported out-right illiteracy among native-born whites."[14]

Civil war and industrialization shattered this cozy marriage of verbal text and visual image and loosened the historian's tie to texts. The Civil War left too many loose ends, especially because Americans could interpret it as either a vindication or a failure of a unified tradition embodied in written texts. History writers had to grapple with the war's terrifying and unsettling themes. And they also had to confront the war's new visual heritage: photography, which transmitted the brutality, not the glory, of mass destruction. During the war, an insatiable public demand for pictorial images stimulated the rise of illustrated magazines and provided plenty of employment for master sketch artists like Frank Leslie. Furthermore, the perfection of lithographic technology equipped the graphic arts with a magnificent array of tools. Engravings--be they woodcut, steel, or line--now could be supplanted by tremendously detailed pictures completely under the control of the illustrator, pictures that could be transferred cheaply and efficiently to the printed page.[15]

Photography, unlike engraving, eliminated the middle man. Americans invested the new medium with powers of realism and natural replication that they would apply later to radio and television. The camera could capture Nature, unlike the engraver who acted as the medium

between the sketch illustrator and the reader. Even engravers who had striven for accuracy in depicting natural scenes could not compete with the camera. Here, in the words of Oliver Wendell Holmes, was a "mirror with a memory" capable of bringing history directly before the eyes of nonparticipants.

The advent of photography coincided with the professionalization of history. A new generation of scholars trained in history as an academic *science* that painstakingly reconstructed the past succeeded the generation of ministers, lawyers, journalists, and scissors-and-paste compilers responsible for the writing of textbooks. The new history's revolt against romanticism and the literary tradition of history writing exalted the uncovering and transmission of facts unmediated by the personality of the writer.[16] History writers still held to the narrative form, but they directed its course with what they believed was a rigorous chain of cause and effect derived from the tedious analysis of the record.

At its beginnings, photography was not regarded as a form of artistic expression. It was instead another way of documenting reality. The camera, not the photographer, controlled the picture. Furthermore, photographs recorded the unusual, the *significant*, the prominent scenes of life. For example, by the turn of the century, as the Civil War faded from memory into history, photographic and pictorial histories flooded the mass market. Perhaps more photographs were available to the public then they are now, and their subjects ranged from the boredom of camp life to the eventful turning points of a presidential assassination and the execution of his murderers.[17]

The possibilities for textbook illustrations seemed limitless. But judging by the textbooks in use up through the 1920s, almost a half century after the appearance of photographic transfer processes, history text writers resisted the trend. Although textbooks incorporated some photographic, half-tone illustrations, the pictures rarely conveyed unique or discrete historical events. Frequently books printed pictures of pictures: photographs of paintings and sketches. Even though many mid-nineteenth-century public figures rushed to have their pictures taken, history texts fifty years later preferred line portraits over the original photos. One possible reason: writers, proclaiming their fidelity to the truth, thought that photographs conveyed unnecessary truths by showing history's heroes warts and all. The publication in 1890 of Jacob Riis's pioneering photographs of slum life in turn of the century New York alerted Americans to the sobering power of photography--yet none of his startling images appears in American history texts before the 1930s. Like Riis's photographs, the images of the Civil War came to the public largely by way of illustrated magazines and mass media--not a single academic historian associated himself with the use and preservation of this new form of recording the past.

Another and perhaps more powerful explanation for the continued resistance of history texts to graphic arts and photography was the nature of the competition. With the achievement of high and sustained literacy rates by the end of the century, the public's access to mass media widened at a furious pace. The hallmarks of modern mass communications, especially its commercial character and individualistic thrust, were already evident by the 1840s. As the century passed, mass advertising and the expansion of visual technology affirmed the triumph. Americans fascinated with the drama of recent history not only could flock to new museums, where photographic and other graphic displays awaited them. They could vacation there, take their cameras with them, and return with pieces of history for proud display in their very own parlors.[18]

Faced with such competition, the history text stayed the course: its emphasis

on narrative, on high politics, on macro events like industrialization, war, and territorial expansion remained essentially unchanged and undocumented by visual images. Teachers could set aside the text and use new forms of historical evidence to challenge their students, while professional historians still grappled with the problem of trying to develop a method of interpreting photographs and establishing their validity as historical sources. Change would come fitfully. Albert Bushnell Hart's "New American History," published in 1917 and destined for many editions, informed the teacher that its pictures "with the exception of a few reproductions of famous paintings, are all realities, intended to place before the pupil in visible form the faces of public men, the surroundings of famous events, and some of the national monuments and buildings.[19] Yet even Hart's book preferred artist's reproductions over original photographs. Photography was not art; art could more readily be bent to the needs of the publisher and agenda of the writer. In 1928, Row, Peterson, and Company, a major textbook publisher, announced that "for the first time original three color illustrations have been used in an elementary history text." The authors, a trio of the profession's finest scholars, boasted that:

> The physical beauty of the book is due to a conviction which the publishers share with the authors, that school children are entitled to textbooks having artistic qualities at once interesting and faithful to truth. No effort has been spared to make the illustrations of this textbook reinforce the story told in words. Contemporary photographs, drawings, and cartoons having special historical value have been liberally used. Scenic views portray our country's natural beauties and its economic development. Reproductions of painting and statuary enable the child to visualize persons and things that they commemorate, and give him a visible expression of an important phase of our development expressed in art.[20]

And what was the *truth* the book tried to convey? "The story of the greatest of the American nations" a "dramatic and inspiring story--a moving picture of brilliant colors and stirring action." The book's illustrations were, largely, artists' conceptions of events, material culture, and people. Photography just framed a story controlled by the author; it had yet to enter the textbook universe as an independent historical source. Up through the 1930s, publishers and authors preferred artwork over photographs, even after photography had been in existence long enough to record events and become a powerful tool for the history teacher. Although the patriotic, ethnocentric themes remained as the driving force in the writing of these texts, the preference for artwork over photography suggested that historians persisted in the desire to control the action and thereby the reaction of the reader. Photographs, when included, had to be *explained* to the reader, to prevent misconceptions and connect the image to the story. Artwork was more malleable and could convey emotions, prejudices, and ideas that photography supposedly had yet to capture.

Long after photography itself had become recognized as an art form that manipulated images of reality, long after the campaigns for verbal literacy achieved their greatest successes, historians remained tied to texts supported by artful and inaccurate graphics. As historical conventions and pedagogical theory changed, artwork marched along in steady support. Progressive era educators and historians revised history and the curriculum in alignment with new historical theories about class relations and new educational theories about the socializing of children. Texts down-played recitation and emphasized analysis and the expression of feelings.

This was true regardless of the writer's political agenda, for in the 1930s,

texts employed artists to illuminate the darker sides of American life. Leo Huberman's elementary text "We the People," (1932) relied entirely on Thomas Hart Benton's evocative black and white sketches of class distinctions, the horrors of the slave trade, and the deadening impersonality of industrialism to support its progressive critique of American history.

I suspect that a similar tale could be told about the impact of electronic media on the teaching of history. The radio, the LP, and the motion picture seemed to Americans to be other mirrors with a memory: ways of transmitting real events unmediated by the personality of trained experts. But a number of developments, especially the use of mass communications both as political propaganda by totalitarian regimes and for advertising, made it clear that visual technologies transmitted not reality, but a number of interpretations of reality. Television so quickly diffused throughout and flattened the culture that its impact remains to be assessed fully. By making the viewer an eyewitness, it seemed to have pulled down the final barrier between a history distant and intangible and the making of events for future generations to witness.

The history textbook tried to adapt. In the aftermath of the second world war, the country's reflexive concern about recovering lost values and protecting them against ideological enemies of foreign and domestic origin reinvigorated the teaching of history with a sense of vital purpose. Publishers came out with ever more lavishly illustrated editions, filled with maps, charts, and photographs. The cycle of historical revisionism, with its assumption that generations rewrite the country's history, encouraged text writers to pose difficult questions and print more controversial images. The common school reformers had defined republican citizenship as a patriotic faith, leavened with vigilance for one's rights, but based almost entirely on the *moral capacity* of individuals to make public decisions. In this view, education required the training of the child's moral sense so that he could act rightly on the information drilled in to him day by day. Americans by the middle of the twentieth century had significantly muted this exclusivity. Cultural literacy entailed not simply the ability to read and write, but also the development of critical, independent thinking in public affairs.[21] Educators in both time periods shared the basic consensus that a republican form of government was best suited to the American character, but they had very different notions of that *character* and how it was formed.

Recently, there has been a surge of interest in the question of declining literacy rates.[22] Some historians, noting that the supposed decline dovetails with the decline of narrative forms and the rise of visual technology, have tried to maintain the old emphasis on reading and textual analysis. The textbook publishers, on the other hand, have moved vigorously into the multimedia markets, aggressively pushing CD-ROM texts that provide instant access to picture, photograph, chart, and word. Yet the publishers also display an overweening sensitivity to the historian's and the teacher's desire to control the story. For even though multimedia workstations and CD-ROM databases free the student from the tyranny of text, they do not, so the argument goes, free the student from the teacher.

In the past decade, historians have been responding, if belatedly, to the challenge of visual technology. While they are quarelling about the relative biases of narrative forms, they are moving to understand the nature and impact of visual technology. Scholarly committees of the professional societies are investigating the development of electronic archives, the transmission and durability of electronic texts, the use of computer-based simulations and desktop publishing, and the collating and preservation of the rapidly deteriorating yet vast array of photographs that languish uncataloged in museums and historical agencies. To accomplish this important task, historians

need to develop a set of basic criteria for interpreting visual images, as they have had for understanding the documentary record. Ancient, medieval, and biblical scholars have for years studied the nature and method of text illumination, and have produced loose systems for interpretation and analysis.

Simply put, historians and educators should consider mounting a visual literacy campaign of the magnitude and energy of the early common school reformers. Historians and teachers working with visual images, especially photographs, television, and film, need to alert students to the inherent biases of these formats. Students will be willing partners in the endeavor, for they seem more capable of critiquing film and tape than they are of printed text. In that way, they can test the truth of Oliver Wendell Holmes's definition of the photograph as an illusion with the "appearance of reality that cheats the senses with its seeming truth."[23]

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[1]See Peter Novick, *That Noble Dream: The "Objectivity Question" and the American Historical Profession* (New York, 1988).

[2]See, for example, Elizabeth Ellsworth and Mariamne H. Whatley, *The Ideology of Images in Educational Media: Hidden Curriculums in the Classroom* (New York, 1990). On the country's emotional and ideological investment in postwar education, see Diane Ravitch, *The Troubled Crusade: American Education, 1945-1980* (New York, 1983).

[3]For a good bibliography, see Jean Dresden Grambs, The Study of Textbooks and Schoolbooks, A Selected Bibliography in William E. Patton (Ed.), *Improving the Use of Social Studies Textbooks*, National Council for the Social Studies Bulletin #63 (Washington, 1980), pp. 61-76. The standard content analysis is Ruth Miller Elson, *Guardians of Tradition: American Schoolbooks of the Nineteenth Century* (Lincoln, 1963); J. Merton England, "The Democratic Faith in American Schoolbooks, 1783-1860." *American Quarterly* 15 (1963): 191-199; Lee Soltow and Edward Stevens, *Rise of Literacy and the Common School in the United States: A Socioeconomic Analysis to 1870* (Chicago, 1981), pp. 11-22; Carl F. Kaestle, *Pillars of the Republic: Common Schools and American Society, 1790-1860* (New York: 1983), pp. 35, 75-103; Lawrence Cremin, *American Education, The National Experience, 1783-1876* (New York, 1980), pp. 490-495; Baker, "Learning to be Americans," in Her *Affairs of Party: The Political Culture of the Northern Democrats in the Mid-Nineteenth Century* (Ithaca, 1983), pp. 71-107; D. J. Booth, "Popular Educational Thought of the Early National Period in America, 1776-1830..." (Ph.D. Dissertation: University of Colorado, 1974); R. Freeman Butts, "Historical Perspective on Citizenship Education in the United States," in *Education for Responsible Citizenship* (New York, 1977), pp. 47-68.

[4]Marcius Willson, *A Critical Review of American Common School Histories* (New York, 1847) p. 1.

[5]Samuel R. Hall, *Lectures on School-Keeping* (Boston, 1829), pp. 95-98.

[6]Baker, *Affairs of Party*, pp. 91-105.

[7]A straightforward description of content, organization, and style may be found in John A. Nietz, *The Evolution of American Secondary School Textbooks...Before 1900* (Rutland, Vt., 1966).

[8]Neitz, *Evolution*, pp. 2-6.

[9]2 vols. (New York, 1859).

[10]E. Jennifer Monaghan, *A Common Heritage: Noah Webster's Blue-*

Back Speller (Hamden, Conn., 1983), pp. 128-130.

[11]Michael Warner, *The Letters of the Republic: Publication and the Public Sphere in Eighteenth-Century America* (Cambridge, 1990).

[12]Pardon Davis, *The Principles of the Government of the United States. Adapted to the Use of Schools* (Philadelphia, 1823).

[13]Hermeneutics was introduced to the United States by the country's first self-proclaimed political scientist, Francis Lieber, who was trained by German scholars conversant with ancient texts. See Francis Lieber, *Legal and Political Hermeneutics* (Boston, 1839) and Lieber's discussion of language as "the greatest link and tie of humanity" in two of his works, *On Civil Liberty and Self Government* (Philadelphia, 1859), 2:185-86, 424,134, and *On History and Political Economy,...* (Columbia, 1836), p. 14. Post-modern thinkers have radically reoriented hermeneutical methods away from Lieber's intentionalist perspective. See Shaun Gallagher, *Hermeneutics and Education* (Albany, 1992), esp. p. 350.

[14]Carl F. Kaestle, et al., Eds., *Literacy in the United States: Readers and Reading since 1880* (New Haven, 1991), p. 25.

[15]These developments can be traced in Estelle Jussim, *Visual Communication and the Graphic Arts: Photographic Technologies in the Nineteenth Century* (New York, 1974) which covers more than its title implies.

[16]Novic, *That Noble Dream*, pp. 21-46.

[17]For a discussion of the reaction to photography, see Lawrence Levine, *Highbrow/Lowbrow: The Emergence of Cultural Hierarchy in America* (Cambridge, 1988), pp. 160-163; and Jussim, *Visual communications*, passim.

[18]Richard D. Brown, *Knowledge is Power: The Diffusion of Information in Early American, 1700-1865* (Oxford, 1989), p. 219.

[19](New York, 1917), p. v.

[20]Authors' note, Eugene C. Barker, Walter Prescott Webb, William E. Dodd, *The Growth of a Nation: The United States of America* (Evanston, 1928), p. vi. The publishers claimed that "the pictures tell a true story of some event or personage in American history."

[21]Richard Pratte, *The Civic Imperative: Examining the Need for Civic Education* (New York, 1988).

[22]Kaestle, et al., *Literacy in the United States*, pp. 74-148, analyze contemporary reading levels and dispute claims of a decline in literacy.

[23]Quoted in James West Davidson and Mark Hamilton Lytle, *After the Fact: The Art of Historical Detection* (Knofp, 1981), p. 229.

Short-Title List of Teacher's Manuals, History, and Civics Texts Examined

Barker, E. C., et al. (1928). *The growth of a nation: The United States of America*. Evanston.

Bradford, A. (1840). *History of the federal government, for 50 years from March 1789 to March 1839* . Boston.

Brownell, H. H. (1854). *The people's book of American history, comprising the new world* . Hartford.

Burleigh, J. (1848). *The American manual, ...adapted to the use of schools, academies, and the public* . Philadelphia.

Butler, F. (1826). *A history of the United States of America. With a geographical appendix, and a chronological table of contents. For the use of families and schools* . Buffalo.

Butler, F. (1821). *A complete history of the United States of America, Embracing the whole period from the discovery of North America, down to the year 1820.* Philadelphia.

Connor, R. D. W. (1921). *The story of the United States: For young Americans.* Raleigh, NC.

Davis, P. (1823). *The principles of the government of the United States. Adapted to the use of schools* . Philadelphia.

Fisher, R. S. (1854). *The progress of the United States of America from the earliest periods, geographical, statistical, historical.* New York.

Flanders, H. (1860, 1874). *An exposition of the constitution... Designed as a manual of instruction.* Philadelphia.

Frost, J. (1838). *The history of the United States of North America.* London.

Goodrich, C. A. (1833). *A history of the United States of America...to the present time.* Hartford.

Goodrich, S. G. (1850). *A pictorial history of America: Embracing the northern and southern portions* . Hartford.

Graff, H. F. (1972). *The free and the brave* (2nd ed.). New York.

Green, R. P., et al. (1984). *The American tradition: A history of the United States.* Columbus.

Grimshaw, W. (1841). *History of the United States* . Philadelphia.

Hall, S. R. (1829). *Lectures on school-keeping.* Boston.

Hart, J. S. (1862, 1874). *A brief exposition of the constitution of the United States for the use of common schools.* Philadelphia.

Hart, A. B. (1917). *New American history* . New York.

Hickey, W. (1854). *The constitution of the United States of America, with an alphabetical analysis.* Washington.

Hopkins, C. T. (1872). *A manual of American ideals.* San Francisco.

Howe, E. P. (1861). *The young citizen's catechism...Together with rules for parliamentary and commercial business. Designed for schools* . New York.

Howitt, M. (1860). *A popular history of the United States of America from the discovery of the American continent to the present time* . New York.

Judson, H. Pratt. (1906). *The growth of the American nation* . New York.

La Rue, D. W. (1924). *The child's mind and the common branches* . New York.

Lord, J. (1854). *A new history of the United States of America, for the use of schools.* Philadelphia.

Lossing, B. J. (1857). *A primary history of the United States, for schools and families.* New York.

Mansfield, E. D. (1834, 1855). *The political grammar of the United States.* New York.

Mason, C. (1842). *An elementary treatise on the structure and operations of the national and state governments...for the use of schools and academies and for general readers.* Boston.

McCartney, W. (1847). *The origin and progress of the United States.* Philadelphia.

McCulloch, J. (1813). *A concise history of the United States, from the discovery of America, till 1813* (4th ed.). Philadelphia.

Olney, J. (1836, 1851). *A history of the United States,...to which is added the constitution of the United States.* New Haven.

Olney, J. (1836). *A history of the United States, on a new plan; adapted to the capacity of youth.* New Haven.

Page, D. W. (1847). *Theory and practice of teaching: Or, the motives and methods of good school-keeping.* Syracuse.

Parker, Rev. D. (1848). *The constitutional instructor.* Boston.

Parker, F. W. (1894). *Talks on pedagogics: An outline of the theory of concentration.* New York.

Quillen, I. J., & King, E. (1951). *Living in our America: History for young citizens.* Chicago.

Sheppard, F. (1855, 1866). *The constitutional text-book.* Philadelphia.

Sullivan W. (1831). *The political class book.* Boston.

Taylor, C. B. (1831). *A universal history of the United States to the present time.* New York.

Watson, H. C. (1853). *History of the United States of America, from the discovery to the present time.* Philadelphia.

Willard, E. (1854). *Abridged history of the United States.* New York.

Williams, G. S. (1872). *The constitution of the United States. For the use of schools and academies* (4th new and enlarged ed.). Cambridge, MA.

Willson, M. (1847). *Juvenile American history for primary schools.* New York.

Woodburn, J. A., & Moran, T. F. (1906). *American history and government: A text-book on the history and civil government of the United States.* New York.

Young, A. W. (1835 through 1900). *Introduction to the science of government.* Warsaw, NY.

Young, A. W. (1845). *First lessons in civil government* (8th ed.). Auburn.

THE VIDEO IN THE CLASSROOM: AGATHA CHRISTIE'S "EVIL UNDER THE SUN" AND THE TEACHING OF NARRATOLOGY THROUGH FILM

by
Michael Kokonis

Educational technology has made tremendous strides in introducing the new audiovisual and electronic media in the teaching of any subject, especially language teaching. Since the 1980's many institutions have adopted the use of video over traditional film technology because it is less costly and more user friendly. It is natural to expect that there are many technology-prone teachers who make ample use of the new technologies in the teaching of literature as well. However there is little documentation of specific methods of video use in the literature classroom. The aim of this paper is to suggest some ways in which the versatile facilities of video can be put to effective use in teaching literature as well as cinema courses at a college or university level, with the intent to promote audio-visual literacy. The method proposed for video applications to the teaching of literature, especially fiction, presupposes an approach to narrative through the tenets of narratology, the discipline that examines texts of narrative fiction as narratives, irrespective of their mode of manifestation (whether verbal, visual, or other).

Methods and Aims of Teaching Literature on Video

There has been considerable research done on the practical applications of video, which has enjoyed wide use in all fields of education in thousands of institutions all over the world. However, most of the research has been concentrated on video as an aid to support language teaching.[1] The software video material employed varies from documentaries, advertisements, news, and general entertainment, including film narratives. But even when film narratives are used, the aim is either to improve speaking and writing language skills, or, in extended curricula, where literature and the arts are integrated in language courses, films shown on video are meant to help students appreciate literature to improve writing and composition.[2]

As far as literature courses themselves are concerned, there have been only a few articles or books exploring methods for using commercial films on VCRs to study themes, formal elements of literature, literary terms, and the aesthetic decisions behind film adaptations of literary works, as for example in the manner described by R. H. Fehlman (1987), in "Quoting Films in English Class." A practical method is suggested by Rodney D. Keller (1985) in "Movies and Literary Elements," a paper presented at the International Reading Association Conference, in Idaho: The writer proposes showing short, ten-minute movie clips to motivate students to read literature and explore elements of fiction such as plot, character, setting, symbol, irony, and theme.

In other cases, movies are shown for comparative purposes, e.g., between literature and cinema, in courses concentrating on problems of adaptation. Thierry Lancien's (1988) "Litterature et cinema: de la page a l' ecran" (Literature and Film: From Page to Screen) is a case in point, since the article looks at the process of making a novel into film by focusing on comparisons of composition, characters, and language. Similarly, Sue Heibling (1985) in "The Dollmaker: A Cross-Media Approach," uses the novel and television adaptation of Harriet Arnow's "The Dollmaker" to teach problems of translating literature into film. Problems of adaptation from a literary to

film narrative pose no obstacle to developing a teaching methodology for the practical analysis of narratives provided that they are explained to the students early in the course.

Far more interesting, however, is an approach of examining a literary topic in an interdisciplinary manner, that is, by placing it in the wider context of art. Dorothy M. Jehle (1990) in "Medieval Romances: Perceval to Monty Python," traces the appearance of medieval themes, motifs and characters in works of modern poetry, fiction and films. Also interesting is the notion of drawing on the tenets of a particular theory from one discipline and applying these tenets to another: For example, the application of literary theory to film theory. Lynn Kear (1988) in "Teaching Film Studies: The Viewer Response Approach," examines how Louise Rosenblatt's reader response theory can be applied to film study in the classroom. In the view of reader response theorists, although there are differences between film and literature as media, the processes that one uses to make sense of literature and film are similar.

Narrative as a Teaching Subject on Video

The approach to be followed here will also account for the similarities between reader and viewer response, but it will be couched within the wider perspective of narratology, which takes care of the more complex relationships between author and text as well as reader and text. Narratology is the discipline that examines texts of fiction primarily as narratives, irrespective of the mode of their discursive manifestation, that is, verbal, visual, or audiovisual. The terms *author*, *reader*, and *text* are employed in the broad sense of the words, meaning both filmmaker and novelist, film viewer and novel reader, and novels and films respectively. According to narratologists, the same story, conceived as the content of narrative message, can be transmitted in a number of ways, for example in the form of a novel, a comic-strip, a series of paintings, a film, a television miniseries, a ballet, a play, and so on. The expression codes pertaining to the nature of different media may affect the mode of narration and the formal organization of the narrative up to an extent, but basically the story-content remains the same because it obeys the inherent narrative codes shared by all media. In this case, having taken into consideration the difference between the verbal narrative discourse of the novel and the audiovisual mode of narrative presentation in film, I will attempt to explore their commonly shared codes of narrative form and structure. Highly abstract notions, such as narrative structure, focalization, retrospective, and reiterative narrative strategies, etc., will be easily comprehensible because they will be presented visually through film excerpts on video, each video clip illustrating an abstract idea.

A narrative then, in the form of a film adapted from a novel, can be an excellent case study for explaining and illustrating aspects of the theory of narrative fiction. In the last two years I have been using Guy Hamilton's "Evil Under the Sun," a detective story film, based on Agatha Christie's classic of the same title, for this purpose in my Introduction to Fiction course. It is a course addressed to freshmen with the aim to introduce them to basic elements of the theory of narrative fiction. The reason why a detective story is chosen from all possible genres, is because the detective story is an archetypal form for all narrative, as it will be demonstrated later. But first a few words on the nature of narrative seem to be in order here.

Narratologists posit three terms for the textual analysis of narratives: Story, Text, and its Narration. Story and Narration are conceived in abstract terms, while Text is the only concrete entity available to the reader. Text is what we actually experience, while reading or viewing. "In it [the text], the events do not necessarily appear in chronological order, the characteristics of the participants are dispersed throughout, and all the items

of narrative content are filtered through some prism or perspective (focalizer)" (Rimmon-Kenan, 1983, p. 3). Reconstructing the narrated events in their natural chronological order occurs at the stage of analysis, after reading the text, and it is an exercise in abstraction. This is so because the reader reconstructs the narrative experience in his or her mind. Also, the act of narrating and the role of the narrator are abstract concepts; narrators and narratees are theoretical constructs employed to distinguish them from the real author or reader. The notions *narrators* and *narratees* are deciphered by reading indexical signs of their presence scattered through out the narrative. Thus, from what is inscribed in the text, we are able to appreciate authorial voice and attitude both towards the narrated events as well as toward the reader. By employing a film narrative as a case study, we take advantage of the concreteness and immediacy of cinematic image, as well as the versatility of video use, to render the above mentioned theoretical abstract notions more tangible and understandable.

In practice, the method of video application to the teaching of core theoretical issues is the following: A single session is devoted to the viewing of the entire film without any interruptions, so as not to spoil the pleasure of the first reading. Then in the next session, an analysis of the film's structure is attempted, introducing certain aspects of theory, such as plot structure and design, narrative strategies and modes of narration, the role of the narrator, and textual relationships. Specially selected excerpts from the film text are shown to illustrate abstract theoretical concepts in their complex interrelationships.

Analyzing the Film Text

The Nature of the Text and Textual Relationships

A good starting point is the complex relation between text and reader, which is central to the theory of narrative fiction. Rimmon-Kenan (1983) notes that this relationship derives from the paradoxical nature of the text itself:

> There is one end every text must achieve: it must make certain that it will be read; its very existence, as it were, depends on it. Interestingly, the text is caught here in a double bind. On the one hand, in order to be read it must make itself understood, it must enhance intelligibility by anchoring itself in codes, frames, *Gestalten* familiar to the reader. But if the text is understood too quickly, it would thereby come to an untimely end. So, on the other hand, it is in the text's interest to slow down the process of comprehension by the reader so as to ensure its own survival. To this end, it will introduce unfamiliar elements, it will multiply difficulties of one kind or another, or simply delay the presentation of expected, interesting items. (p. 122)

Of course authors are well aware of the nature of the text, which progresses by employing delaying devices. They are also aware of the reader's propensity to speed up reading in order to discover the *secret* of the narrative--all narratives do have a *secret*, as a rule.[3] Therefore, during the actual act of writing, the author calculates in advance the effect of his special techniques to generate suspense and promote pleasure in the reader. The secret of the narrative is well kept until its revelation time, the text does not yield its meaning too easily and therefore does not come to an *untimely end*. In a sense, this antagonistic relationship between author and reader constitutes the game of fiction, with the text being a kind of shared common territory, a play field where their imaginations engage in a competitive struggle.[4]

The detective story by nature is the kind of narrative that best illustrates this notion of fictional game, since the *secret of the narrative* becomes literally the secret

that the process of detection aims to uncover. A detective story "purports to narrate the course of an investigation, but the 'open' story of the investigation gradually unravels the 'hidden' story of the crime. In other words, the initial crime on which the tale of detection is predicated is an end as well as a beginning. It concludes the 'hidden' story of the events leading up to itself at the same time it initiates the story of the process of detection" (Porter, 1981, p. 29). Since the crime in detective fiction becomes the tangible goal in the competitive struggle between author and reader, the game of fiction in detective stories has a more antagonistic character than in other genres.

"Evil Under the Sun" is a good example. It is a typical Agatha Christie story telling the sudden and unexpected murder of a former theatre actress, Arlena Marshall, on the beach of a resort island on the Adriatic. Having interrogated all the guests at the hotel and finding an alibi for each one of them, Hercule Poirot is nevertheless successful in eventually unravelling the identity of the murderer. In Guy Hamilton's film version of the story this process of investigation is graphically and vividly dramatized.

The film respects the ingenuity of the structure, so characteristic of the Agatha Christie story, although there are some minor plot alterations. The balance between ratiocination and mystification, so artfully created by Agatha Christie in the novel, is also maintained in the film, though the expressive means employed are different. After the standard expository sequence introducing the detective, the setting, and the characters, and an additional sequence of complication, stating the possible motives of practically all the characters who would want to murder Arlena, there follows the scene of the crime and clues. As usual in formulaic structures of this kind the story of the crime remains secret. The viewer is not given a chance to witness the actual murder, only the discovery of the murdered body. This will initiate the process of investigation that will maintain the viewer's interest undiminished until the end. Most of the narrative is taken up by the process of investigation. No matter how hard we, as viewers, try to speed up ahead of the narration and discover the culprit, that is, the murderer, we fail.

As a matter of fact, Poirot gives us a clue too many. This can be shown on video through the dialogue scene involving Daphne Castle, the hotel proprietor, Sir Horace Blatt, a business tycoon who has commissioned Poirot to find his lost diamond, and Hercule Poirot himself. When Poirot tells them that he is going to reveal the identity of the murderer after breakfast, both Daphne and Sir Horace are surprised and thrilled:

"You mean you know?" they ask him eagerly. "Well, give us a few clues." And then Poirot gives them a whole list: "All right, I wish you to consider very carefully: a bathing cap, a bath, a bottle thrown to the sea, a wrist watch, the diamond, the noon-day gun, the breath of the sea, and the height of the cliff. From that you should be able to solve it yourselves."

But due to the fact that we are overwhelmed by the multitude of clues and the fact that they are given to us verbally, therefore, in abstract form, we can intensify the challenge of the mystery by making use of the versatility of our teaching aid; we can carefully edit the particular shots scattered in the body of the narrative and assemble them together in a visual presentation. Thus we can have the concrete details of all the incriminating clues in a clip: A shot of the bathing cap that Linda is reminded to wear shows what the actual object looks like and, moreover, places it in the particular context of the story. Similarly, some shots of the bath taken by Christine to wash off the suntan lotion from her body establish it as a specific event in the context of eliminating incriminating evidence. The same can be said about the bottle of sun tan lotion she throws over the cliff. Thus, all of these clues acquire an air of particular concreteness and specificity: Linda's wrist

watch as Christine sets it 20 minutes earlier, the false diamond as it drops from Arlena's hand in the grotto, the noon-day gun going off, Arlena's perfume called *Breath of the Sea*, and the height of the cliff from which Christine allegedly waved to Linda. By showing all these details visually, we can make the puzzle of the crime even more vivid and challenging.

In spite of the fact that Daphne and Horace, who act as surrogates for the viewer here, are given so many clues, they still manage to find nothing. This is because, the author has planted various clues and gives us many hints, that instead of helping, confuse us more and retard the resolution process. According to Roland Barthes (1974), some of these clues are *snares*, otherwise called *red herrings*, because they offer outright false information. Others are *half truths, partial answers, suspended answers*, and so on.[5] Again, we can depend on the flexibility of video editing capacity to isolate some of these instances and render them more concrete visually: In most of these cases we can not help noticing the inquisitive probing of the camera through steady pans, tilts and zoom-ins, that guide our attention to inexplicable pieces of action and behavior in some of the characters. For example, why is Christine peering from the balcony of Linda's room at Linda going up the steps? Then what is Mr. Gardner looking at so intensely when following Christine and Linda with his eyes? And whose hand is it behind a tree's branches revealing the two women receding in the garden? What is it off the field of view that causes Daphne's surprised expression? What does the half-eaten carcass of a dead rabbit, consumed by worms, have to do with the story in question? These narrative incidents have absolutely nothing to do with the story offering the viewer clues (red herrings) that mislead the viewer and impede the progress of the narrative toward resolution.

Further, in a slow zoom-in we are presented a view of the hotel, and as the camera zeroes in on Kenneth's room we see his troubled or puzzled face through the curtains looking over the bay. The next shot is that of Arlena sunning herself at the beach alone, though we fail to see the connection. There are so many clues scattered throughout the sequence which confuse the issue and make matters more complicated, leading us astray. A visual presentation of these clues in this manner makes them more telling than a simple verbal description.

Backward Construction of Plot

The role of the detective in tales of ratiocination or detection parallels the role of the reader in encountering a narrative. Like the ideal reader, "the detective," as Porter (1981) remarks, "encounters effects without apparent causes, events in a jumbled chronological order, significant clues hidden among the insignificant. And his role is to reestablish sequence and causality" (p. 30). Peter Ustinov's incarnation of the notorious Hercule Poirot type is impeccable. As in the novel, the character of the idiosyncratic and whimsical Belgian super-detective, with the beady eyes and the curly moustache, is faithfully represented in the film. He is patterned after the traditional image of the artist-hero, initiated by Poe, with colossal ratiocinative powers and a keen eye for details, no matter how trivial or insignificant. In the film's narration, the camera identifies with Poirot's point of view most of the time, thus making the detective a surrogate for the viewer. And yet, despite the fact that we experience almost all events exactly as Poirot perceives them, we are surprised to find out that, as viewers, the solution to the crime escapes our intellect. On the contrary, Poirot, after some mysterious calculations and considerable reflection, announces he has discovered the identity of the murderer and is ready to explain how the victim was murdered. But we will return to the question of focalization or point-of-view immediately after we consider the plot of the narrative and the manner of its construction.

Detective fiction is characterized by a peculiar structure in which the plot is of primary importance. As mentioned above, the detective story actually consists of two stories, the one embedded in the other. One, the story of the crime, is known only to the criminal and the author. Both have strong reasons to keep it secret. The other is the story of investigation, the story we read. Detective fiction, then, is an archetypal genre exemplifying a displacement of chronological time. As Porter points out, "detective fiction is preoccupied with the closing of the logico-temporal gap that separates the present of the discovery of crime from the past that prepared it" (p. 29). Paradoxically, it is a genre that moves forward in order to move back. The primacy of the plot in detective fiction is clear since so much in the genre depends on the intricacies of the plot. This point was stressed by Edgar Allan Poe, the inventor of the detective tale, in his theory of artistic composition: "Nothing is more clear than that every plot must be elaborated by its dénouement before anything is attempted with the pen. It is only with the dénouement constantly in view that we can give the plot the indispensable air of consequence, or causation, by making the incidents, and especially the tone at all points, tend to the development of the intention" (Davidson, 1956, p. 453). We can demonstrate that the backward construction of narrative, in conformity to Poe's theory of composition, is standard practice in detective fiction and neither Agatha Christie's novel nor Guy Hamilton's movie is an exception.

Having the climactic moment of the unmasking of the murderer and the final explanations of the dénouement--at the end--as the starting point, we can retrace the various stages of plot development by moving backwards. Here is a diagrammatic account of the film's plot moving backwards:

· The ultimate moment of revelation of the crime: The actual scene of the murder followed by minor explanations in the dénouement. The criminals are eventually handed to the authorities.

· Hercule Poirot explaining his brilliant theory of how the murder was committed. Unmasking of the murderers (Patrick Redfern, the actual culprit, and Christine Redfern, his accomplice).

· Poirot announces he has come to the solution of the crime and he is going to reveal everything after breakfast.

· Poirot makes some time measurements with his stop-watch, testing a hypothesis of which we have no idea.

· The investigation itself: Practically all the hotel guests are questioned and all prove to have a "cast-iron alibi." Note that action is shown from the point of view of the suspect, denoting a different version of the story in each case.

· The moment of the crime, preceded by some clues. The actual murder is not shown, just the discovery of the victim's body. Poirot is asked to investigate.

· Complication: Setting the possible motives for each character. Accompanied by foreshadowing of the impending crime.

· Exposition: Introduction of the detective, the characters and the possible relationships between them, and the setting. Heightening expectations in the viewer.

As we move backwards, the author's strategy in constructing the narrative becomes obvious. The climactic moment of revelation is what the author has constantly in mind, and every part of the narrative is constructed step by step, in order to move the plot toward the ultimate moment of resolution. But at the same time, these passages that add to the movement towards closure also delay the final moment of resolution, simply because they take time to process. The plot in detective stories is not important in itself, but for the effects it has on the reader's expectations. Through the

intricacies of plot, the author creates a "composition that plays with the reader's sensibilities, arousing morbid curiosity, and having toyed with it for an appropriate length of time, by satisfying it in a totally unexpected way" (Porter, 1991, p. 27). The more the desired resolution is kept suspended, the more the reader's appetite is heightened and interest in the story is maintained undiminished.

Coming to the practical task of presenting the backward construction of the plot in the classroom, there are two possibilities depending on the time available. If time is limited, we can make use of the still function capacity of the video equipment to isolate the pertinent images from each section of the plot and present them as freeze frames. Their duration can be timed to coincide with the time it will take the instructor to describe verbally each stage of the plot. This technique presupposes that our video equipment will have a perfectly clear image at the still mode. If there is more time available, we may choose to select short one- or two-minute clips from each section, present them piece-by-piece, stopping the action for the appropriate commentary in each case. Thus the backward construction of the plot will be more vividly and adequately presented.

The superiority of video over other teaching aids, such as still photographs, slides, drawings, or diagrams on OHP, becomes apparent. With video clips we can present pieces of action intact, preserving their continuity, revealing narrative events *in motion*. After all cinema is the art of moving pictures, constructed in terms of time and space, two aspects that can be amply and fully presented solely through the use of video.

Aspects of Narration

This capacity of the medium becomes more evident in explaining aspects of narration, for example *focalization* and multiple *points of view*, *flashback*, *retrospective* narration, and the role of the *narrating agent*. In film theory, the notion of the narrating agent is quite problematic. Entering the long debate about the status of the narrator in cinema would be beyond the scope of this paper and would only confuse the issue. Suffice it to say that we have to theorize the existence of a narrating agent in film, who undertakes the telling of the narrative. As far as film narrating techniques are concerned, the standard mode of film discourse is a combination of objective and subjective point of view shots, especially when the director's objective is to enhance audience participation in the film events narrated.

In this film, we might say that objective point of view shots predominate, but there are several cases throughout the narrative, that the camera adopts Poirot's point of view, rendering him the focalizer and facilitating identification with the viewer. For example, early in the story, when Poirot is enjoying his favorite ice cream in a hotel lounge, he is made privy to something interesting. As he glances idly opposite him, he notices a handsome man, who is later proven to be none other than Patrick Redfern, sending his wife on an errant in order to be alone with a mysterious lady. From Poirot's point of view only her hand is seen, adorned by a gold bracelet, caressing Patrick's face. Along with Poirot, we infer that Patrick has an illicit affair with another woman. Later, at Daphne Castle's hotel lounge, right on the first night when all the guests gather for drinks, Poirot notices that the same golden bracelet, shown now on close-up, belongs to Arlena Marshall. At this point, a camera shot adopting Poirot's point of view, stresses the fact that the detective makes a discovery. Moreover, the next shot takes us from Poirot's beady eyes to a close-up of Patrick's face, so that the association of the illicit relationship between Patrick and Arlena is made clear both to Poirot and the viewer.

Focalization shifts occur mostly in two long sequences: (a) When Poirot interrogates the suspects and (b) when he presents his own theory of how the murder was committed. In the first case,

we have a visual account of the events as seen from the point of view of each suspect in his or her version of the story. Thus we end up having multiple storytellers (narrators) and multiple agents of perception (focalizers), through whose points of view we get different approaches to the search for *truth*. These little pockets of narrative content become instances of what narratologists call *analepses*, or as more commonly known, flashbacks.[6] Video is the appropriate means to show these time displacements in the narrative evoked by flashbacks. For example, the same narrative material presented from a different point of view gives a totally different version of the story: The visual presentation of Christine's action leaving Gull Cove to return to the hotel for a game of tennis agrees with the account she gives verbally during her interrogation by Poirot. A slightly different visual presentation of the same events is given during Linda's narration of the story. Finally, a totally different presentation occurs later when Poirot gives his own account of what actually happened. The differences can be immediately registered and be more easily appreciated when shown by video clips.

When the same piece of narrative (given through these flashbacks, each by a different focalizer) is told more than once, we have the phenomenon designated by narratologists as *reiterative* narrative. In other words, the narration shifts back to a posterior point of narrated time and retells the same event. This may be spoken by another agent, who temporarily is invested with the role of a narrator, and can either be witnessed through his or her eyes, or seen through the eyes of someone else. It is a very complicated concept to explain verbally, therefore, by actually presenting it on video, we manage to make it more easily comprehensible. Instances of literative narrative are many: The discovery of Arlena's body, for instance, is shown in the film's diegesis for the first time, when Patrick accompanied by Mrs. Gardner, who serves as a witness, finds her dead on the beach. Both the focalization and the narration are objective, that is, from the point of view of a third party, the film's narrating agent. Later, however, when Poirot develops his theory and refers to this episode, the same scene is presented, this time shot from different angles to designate the point of view of Mrs. Gardner. Now, the view of Arlena's body lying in the sun as experienced from Mrs. Gardner's point of view in the boat is totally different. Mrs. Gardner was not close enough to distinguish whether this was actually Arlena's body, or Christine's, who, according to Poirot, was posing as Arlena in order to establish an alibi for her husband, Patrick, the real murderer. By actually presenting the spatio-temporal dimensions of the narrated events, the argument made verbally by Poirot in the hotel lounge acquires a distinct visual concreteness and lucidity.

Additionally, the instructor has also the chance to illustrate visually the abstract concepts of retrospective (flashback) and reiterative (repetitive) narrative modes, as well as the theoretical notions of narrator, narratee, and narration, which are standard terms in narratology. The best examples to illustrate these ideas can be found in the climactic sequence where Poirot reveals the identity of the criminals. All the guests are kindly asked to gather in the lounge and comfortably seat themselves so that Poirot can start telling the real story of the murder of Arlena Marshall. The scene therefore is set in time present with Poirot narrating the events of the story, thus assuming the role of the narrator, and the guests, listening to the story, assuming the role of narratees. However, as the events of the story of the crime presented by Poirot belong to the past, the diegesis in the present time is interrupted by a series of visual passages, depicting events in time past, while Poirot continues delivering his theory in voice over. In other words, the visuals presenting events in the past support the aural argument of Poirot, acting as narrator, in the present. For example, when Poirot starts developing his theory, he begins by saying that all the suspects seemed to have an alibi, but actually one of them was lying:

"It was you,"--he pauses momentarily, then turns suddenly to confront Christine, "Madamme Redfern!" Several insert shots of various guests in the lounge are added here to register the surprise on their faces. Then a shot of Christine follows defending herself while on the audio band we have the following dialogue: Christine: "Me, but I didn't lie to you, I swear it," Poirot: "Oh yes you did Madamme. en I asked you at what time you left Gull Cove yesterday, you said it was 12 o'clock. You knew this you said, because--the scene is interrupted here with a visual account of this action set in the past, showing Christine leaving Gull Cove and walking among the trees in the path leading to Ladder Bay, where the crime was committed. Meanwhile, Poirot's narration continues in voiceover: "You heard that awful gun go off" (sound of cannon heard in voiceover too), "when you were staying on top of the cliff"--shot of Christine on top of a cliff--"waving at Linda who was swimming in the water below." End of flashback, the narration returns to time present and the camera focuses on Poirot as he resumes his argument: "But Mr. Brewster was in the bay at the same time, it is very curious that you did not mention him. ...And yet he made no mention of you standing over the cliff. Why not?" Poirot now looming over Christine:. "The answer is very simple." Cut to the empty cliff: "You were not there!" This scene in which visual presentation shifts freely from the lounge (time present) to events in the past (in flashbacks) is an illustration of the concept of retrospective narration.

Besides, in order to support his argument, Poirot will refer himself to events that had happened prior to the time of the crime, which was established between 11:30 and 12:30 of the second day on the island. For instance, when Christine denies that she descended the ladder at Ladder Bay, where Arlena was sunning herself--as Poirot insists, she brings up the point of her suffering from vertigo. She would not have been able to climb down the ladder, she says, because she was afraid of heights. The flashback showing Ladder Bay ends with a cut to the lounge, with Christine speaking: "But I couldn't have climbed down the ladder, I suffer from vertigo! You know that." Cut to Poirot: "I only know that because you took good care to stage an incident showing me that you suffer from vertigo. Immediately the narration repeats the same scene shown quite early in the narrative where Christine had leaned against Poirot's shoulder, having a stroke of acrophobia at the edge of the terrace. This is an instance of reiterative narrative when the narration returns to repeat the same scene in a different context. During Poirot's narration of the story of the crime there are several such cases of repetitive or reiterative passages.

Conclusions

Video can be an excellent means to teach aspects of narrative theory. Through the presentation of elements of narratology it was pointed out that certain ideas are more abstract, just because they are theoretical, ideas pertaining to Story and Narration. But due to the capacity of video to make elusive and abstract ideas accessible and concrete, the difficult task of teaching literary concepts becomes easier and pleasurable. Moreover, even in the case of dealing with the rather concrete items of the Text, such as any of the particular details describing characters, events, and setting, video is equally helpful in rendering them more concrete and specific. These conclusions are drawn from practical experience in teaching elements of narratology during the last five years. There has been a distinct difference in student comprehension of literary and theoretical concepts between the first three years, when no video was used in this course, and the last two years, when film was introduced as a teaching aid. Although no formal attempt was made to measure the degree of the students' comprehension of the literary concepts taught in the course, personal observation of class discussions and evaluation of examination papers revealed that the students did in fact benefit from these simultaneous explorations in literary and

cinematic concepts through the use of video.

Footnotes

1 A typical sample of this kind of research in the U. K. is indicated by such article titles as: *Video and English Language Teaching in Britain*, pp. 1-17; *The Potential and Limitations of Video*, pp. 17-29; *101 Ways to Use Video*, pp. 43-57; *Video Applications in English Language Teaching*, pp. 69-83. In John McGovern (Ed.), (1983), *Video Applications in English Language Teaching*, ELT Documents Series, Pergamon Press in Association with The British Council.

2 For example, Baird R. Shuman & Denny Wolfe (1990), *Teaching English Through the Arts: Theory and Research into Practice*. The National Council of Teachers of English, Urbana IL. As stated in the Abstract, this book discusses teaching English through the arts...and intends "to help students make stimulating connections between English and some of the arts they know best--popular music, film, photography, design, drawing and painting, and drama. Following a brief discussion of the theoretical and research-based support for their ideas, the book presents 15 activities that focus on language, nine that focus on literature, and five that focus on writing."

3 Pierre Macherey (1978) observes that the movement of the novel is double: "the mystery must be concealed before it is revealed. Until that crisis the secret must press upon the mind or the heart of the hero, and the entire elaboration of the narrative consists in the description and the organization of this delay" (p. 29).

4 Play or Game theory has been evoked by a number of critics to explain the playful and game-like character of fiction. See Peter Hutchinson (1983), *Games Authors Play*, Methuen; R. Detweiler (1976), "Games and Play in Modern American Fiction," *Contemporary Literature*, *17*, 1, pp. 44-62; E. Bruss (1977), *The Game of Literature and Some Literary Games*, *New Literary History*, *9*, pp. 153-72; for an overview of Play and Game Theory in relation to narrative and a definition of fictional game, see M. Kokonis (1991), *Metafictional Games: The Play Element in Cinema and the Novel*, Ph.D. Dissertation, Aristotle University.

5 In his book *S/Z*, Barthes (1974/1970) notes five types of clues, of different degrees of significance and relativity to the story, planted in various parts of the narrative to enhance the enigma or mystery of the crime. They are part of the *hermeneutic* code of the narrative and their function is to suspend the advance towards resolution and deliberately mislead and puzzle the reader (pp. 75-76).

6 Gérard Genette (1980) employs specific terms for the categories of narrative, such as the flashback or the flash forward: *analepsis* and *prolepsis*. They are inherent codes of narrative discourse and apply to all narratives (p. 40). Also, for the notions of retrospective and repetitive modes in a narrative see the chapters on Order, Duration, and Frequency (pp. 33-160).

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A RHETORICAL APPROACH TO NON-DISCURSIVE MESSAGES IN INFORMATION CAMPAIGNS

by
Kathleen Reid

Public information campaigns have informed and mobilized the American public for more than two centuries. Early efforts were developed primarily by strong, independent individuals who persuaded their followers to particular actions, and by the nineteenth century, these individuals and their followers had developed significant strategies, including grass-roots organizing, legislative testimony, use of mass communication, and confrontation. Priority topics at that time centered upon reform, such as the abolition movement, women's suffrage, and temperance campaigns. The popularity of contemporary American public information campaigns has continued to thrive throughout this century, but with a dominant shift toward the role of the mass media in the information dissemination process. Most recently, public communication campaigns have sought to inform, persuade, or motivate large audiences, usually for noncommercial benefits, with a specified time frame, by organized communication efforts that involve extensive use of the mass media complemented by interpersonal communication (Rogers & Storey, 1987).

As this suggests, public information campaigns serve a primary role in contemporary American society to promote more active citizen involvement in varying dimensions of society. Specifically, when the U.S. government seeks to influence its citizens, it uses the mass media to develop systematic social change. As such, information campaigns become forms "of social intervention prompted by a determination that some situation represents a social problem meriting social action" (Salmon, 1989, p. 20). Today, these campaigns address such diverse issues as health, traffic safety, environmental concerns, and crime prevention.

Dissemination of pertinent campaign information is most often through public service advertisements (PSAs). Sponsorship of most PSAs emanate from not-for-profit or governmental organizations. They receive *gratis* placement in both the broadcast and print media. Because of this free media placement, most do not receive the same status in placement as do regular paid advertisements or commercials. In fact, more appear only as space or time permit with a recently growing number of exceptions (ABC, 1986; Hanneman, McEwen, & Coyne, 1973). O'Keefe and Reid (1990) found that the public is fairly attentive to PSAs, especially those over television and, for the most part, the audience have favorable reactions to them.

Much of the developments of these recent campaign efforts have been through the support and direction of social science. The primary contributions of the social scientists have been in grounding the campaigns in theory, as well as in planning, conducting, and evaluating these efforts (Paisley, 1989). As this suggests, much of the evaluation effort of public campaigns has been upon audience response; however, as works such as that of Grunig and Grunig (1990) and Salmon (1989) indicate, even the strongest social science efforts regarding campaign strategies and development remain at best part art, part science. In light of this, a recent move in evaluations of the campaigns has been to recognize a need for a careful examination not only of the audience, but also the content of both the verbal and visual messages found within

information campaigns.

In this paper, the McGruff "Take a Bite Out of Crime" public information campaign will be examined to provide students and practitioners who develop such campaigns with a methodology for assessing the content of the visual messages they develop for their varying publics. Secondly, this paper seeks to demonstrate what meaning and patterns can be derived from this specific campaign. As Dondis (1974) acknowledges, viewers attempt to organize visual materials. They seek to establish visual patterns that result in intersubjectivity between the creator and receiver of the message. The strength of the organization of the visual elements will determine the clarity of the messages.

A Rhetorical Perspective

One otentially useful ers ective for analyzing the meaning and patterns behind a form of visual communication is derived from rhetoric. Historically, rhetoric has been confined to the study of discursive communication, but, recently, rhetorical criticism has been expanded to include non-discursive elements. These non-discursive forms of communication are deemed parallel to discourse in that they engage our attention, transmit information, and evoke responses from the audience in ways similar to discourse. Here the non-discursive is defined as communication through visual forms such as videography, film, photography, and painting.

That such human activity is within the purview of rhetorical criticism was suggested by the Committee on the Advancement and Refinement of Rhetorical Criticism (Sharf, 1979), which reported that the rhetorical critic "studies his subject in terms of its suasory potential or persuasive effect. So identified, rhetorical criticism may be applied to any human act, process, product, or artifact" (Sharf 1979, p. 21). Karlyn Kohrs Campbell (1974) echoed this sentiment by asserting that "if criticism is to fulfill its function, the rhetorical critic must proclaim: Nothing that is human symbolization is alien to me" (p. 14).

Using the simplest definition, Foss and Radich (1980) indicate that visual communication is within the scope of rhetoric because it is a "conscious production to evoke a response" (p. 47). Burke (1964) adds credence to this view by noting that when visual communication captures our attention, we are as drawn and involved in the communicative relationship as that which "prevails between a pitchman and a prospective customer" (p. 106).

This perspective that parallels the discursive and non-discursive is one that historically can be found with the study of visual arts. Through the years, scholars such as Egbert (1944) in studies of aesthetics and art history have emphasized that visual communication must be understood in rhetorical terms. Gombrich (1960) takes this a step further by noting that good articulation is essential for good communication no matter the form of the rhetorical process: "All human communication is through symbols, through the medium of a language [he includes the visual arts in his notion of language] and the more articulate that language the greater the chance for the message to get through" (p. 385).

These and other theorists hold that visual communicators use their techniques as a medium of rhetoric for expressing ideas and experience just as verbal rhetoric functions to express the experiences of the speaker (e.g., Arnheim, 1971; Kleinbauer, 1971).

Further evidence for the treatment of visual forms as parallel to verbal ones can be found in schools such as the Prague Structuralists that reinforce the phenomenological position that both verbal and visual rhetoric function as social artifacts in the communication process. This work examines how the relationship between creator of an artifact and the interpreter function to form society. This work, especially that of Lotman (1976)

and Mukarovsky (1977), presents both verbal and visual communication as part of the communication process that constitutes our entire social system (Bailey, Matejka, & Steiner, 1980; Lotman 1976; Lucid, 1944; Morawsky, 1974; Mukarovsky, 1977).

Brief Summary of McGruff Campaign

The McGruff "Take a Bite Out of Crime" campaign was conceived in 1979. It has been active with new PSAs developed for each of its fifteen phases. Each phase emphasized specific aspects of crime and violence prevention for varying constituencies of the American public. From its inception, the overall campaign established three purposes: (a) To educate the public, (b) to convince citizens that they can help reduce crime, and (c) to offer clear advice to take direct action for crime prevention. These purposes were based on the assumption and belief that crime prevention can increase substantially the quality of life for everyone. Furthermore, the basic premise of the campaign stressed that if crime prevention were to work, it must originate within communities and be sparked and supported by educational and governmental systems.

As a result of this philosophy, the crime prevention campaign was centered around the cartoon figure, McGruff, the detective dog who "takes a bite out of crime." McGruff functioned as a teacher who did not solve crime but taught people how to help themselves. Most often, he was perceived to be totally trustworthy, never intimidating. He created intense loyalty and believability, especially among children. As a result of audience targeting and consistent dissemination, the campaign has been deemed highly successful. In the process, McGruff, the central figure of most of the PSAs, has become one of the most recognized and trusted public symbols of the 1980s.

The high recognition of the McGruff figure raises the question of what kinds of images and themes are presented in the PSAs to make the Crime Dog so apparently symbolic and identifiable. An examination of the content of the PSAs, both verbal and visual, will document the themes, messages, and appeals that have been conveyed by the campaign since its inception. This analysis will reveal the content that audiences have been exposed to, and how the PSAs establish for the audience a common viewpoint or *world view* that accounts for the role of the individual and community in the fight against crime. The extent that identification and common world view are established between the cartoon character and the audience determines the success of the symbolic functions of McGruff.

Methodology

The formal term for the method used here is cluster analysis (Burke, 1954, 1957). This is a qualitative method involving a structural analysis of the discursive and non-discursive elements of the PSAs. Discursive elements incorporate such elements as layout design, sound effects, tone of voice, and visual elements. Visual elements include design components such as light, color, form, and setting.

Cluster analysis notes that one key to systematizing the varying elements in this PSAs lies in a examination of what elements are presented and juxtaposed against one another. This requires an examination of the basic structure of each and what kind of meaning is developed by the viewer. These varying elements are assessed simultaneously. To establish meaning, cluster analysis examines the structure of the PSAs to determine what elements are associated with what other elements. Cluster analysis asks, "What follows what?" and is concerned with the examination of elements that are linked together by the producers of these PSAs. Cluster analysis establishes the key ideas found in the PSAs and indicates the basic, clearly defined symbols along with the connotative meanings of these symbols as they are established within the announcements themselves.

Cluster analysis consists of three steps. The first is the selection of key terms, or the important element used in the PSA. The key terms are selected because of their high frequency and/or high intensity of use. Frequency refers to how often the term is repeated, and intensity refers to how significant the term appears to be in the announcement. Key terms in these PSAs refer to the words and to the design elements, such as color, form, value, line, and music. The second step is to identify what clusters around, or what ideas are associated with, each key term each time it appears in a PSA. This is a description of what elements are adjacent to or in close radius to each key term. The third step is the interpretation of the clusters. In this step, each cluster is analyzed to determine what messages are included in the PSA. The interpretations of each cluster then are examined as a whole to determine an overall interpretation of the PSA or group of PSAs being examined.

McGruff Campaign Analysis

Since McGruff's inception in 1980, PSAs have been developed that focus on varying themes. Three typical ones include (a) home security/neighborhood watch, (b) crime prevention for a safer community, and (c) children's drug abuse prevention. Each theme area includes a specific grouping of PSAs which will be discussed in turn below.

"Home Security/Neighborhood Watch." Clusters and Interpretation

The home security/neighborhood watch PSAs were distributed in 1980-81 as the first of the McGruff series. These messages appeared on television and radio, and in print in newspapers and magazines, and on billboards, transit cards, and posters. The messages were aimed at adults. The purpose of the ads was to introduce and to encourage the American population to assume responsibility for protecting their homes, and to join with neighbors in doing so. There primary clusters are revealed in these ads: real-life settings and situations, clear action, and McGruff the Crime Dog.

Real-Life Settings and Situations. The real-life settings contain visuals that emphasize the ordinary aspects of the individual's life. The rooms or neighborhood streets that are shown are pleasant and orderly. Even the ordinary moving van used by the criminals in the "Gilstraps" (1981) ad implies how an ordinary setting can unsuspectingly contain elements of crime. In the first "Stop a Crime" (1980) announcements, the darkness of the traditional sitting room in the home of an average middle-class citizen, is turned, literally as well as symbolically, to light with the arrival of McGruff the Crime Dog. In "Mimi Marth" (1981), suspicious actions occur in an everyday street and are halted by a typical elderly woman who has been trained to call the police when she observes unsavory behavior.

Action. Crime-prevention action, such as this simple act presented in the "Mimi Marth" (1981) PSA, is a key element in the home security/neighborhood watch series. The characteristics that cluster around the actions in these public announcements tend to be primarily basic, everyday activities, which can be followed by any individual. The print ad version of "Mimi Marth" (1981) emphasizes this. It is a portrait of an average-looking elderly woman phoning for help, a simple act preventing a major crime. The "Gilstraps" call the police in the televised PSA; again, a simple action to save their neighbor's home from being robbed. The print version of this ad does not so clearly indicate this. Only a small boy in the middle-ground of the photograph intervenes in the burglary. He seems too small to assume this responsibility alone. In contrast, simple use of the telephone in the video version empowers the family so that they are not acting alone but with a broader support system.

As these examples suggest, no special courage, skill, or feat is required to perform the actions advocated in this series

of ads. These are not spectacular behaviors but are simple actions contained in everyday life, such as turning on lights, locking doors, using the telephone. And it is ordinary people who are performing these routine tasks.

McGruff. The items and ideas that cluster around McGruff the Crime Dog include his dissemination of information and community concern, along with his trench coat and security. Also included are his presentation of positive, simple directions and his emphasis upon individual responsibility for the prevention of crime. This cartoon figure is the detective who "takes a bite out of crime," a brief, but highly descriptive summary of the agenda for this campaign. His clear directives present him as a teacher, not so much as a trench-coated sleuth and detective who is out to solve a specific crime. In both the print and video ads, McGruff's trench-coated image makes him a trusted investigator with solutions to problems about crime. His gentle features and his gravelly voice make him an authority to be trusted and believed; he is not intimidating, visually or verbally.

The clusters that appear in these ads stress the significance of individual action in everyday circumstances and settings. This suggests that the individual can play a powerful role in the prevention of crime in his or her life, home, and community. Strength to the individual is imparted through his or her actions which are based upon the recommendations of the crime-prevention expert, McGruff.

"Crime Prevention for a Safer Community." Clusters and Interpretation

The Crime Prevention for a Safer Community PSAs were distributed throughout the ten years of the McGruff campaign, and constitute the most pervasive of the campaign themes. They appeared in print as early as 1981 and first appeared on television and radio in 1982. New messages carrying this theme were introduced each year from 1986 to 1991. The purpose was to teach individuals to protect not just their homes, but innocent individuals when away from their homes. They also advocated keeping streets free of crime, protection at the work sites, prevention of vandalism and arson. All of these stressed the role of crime prevention in varying dimensions of community life. The PSAs were aimed predominantly at the adult audience.

Like the previous theme, the primary clusters of these ads were the settings, clear action, and McGruff the Crime Dog. In addition, these ads emphasized varying types of criminals and the citizens, characterized by both empowerment and vulnerability.

Setting. Once again, many of the settings of the PSAs are ordinary everyday elements. For example, the "Fred McGillicudy" print ad shows an easy chair, dog, pipe, mounted fish, rug, slippers, and newspaper. These household items are ordinary elements of everyday life in America, and they represent the safety and security of the traditional home. These are transferred visually to the external environment by the placement of these items literally on the street with street light and "No Parking" sign. The visual statement is that the street is as safe and secure as one's home. The result is a sense of order and control over both the internal and external environments. Similarly, the print ad for "The Philly Story" depicts a common garden plant waiting to be planted, an ordinary plant and an ordinary task. It reflects the simplicity of simple control over life. Simple plant, simple action combats the confusion and darkness of crime which results in a better community.

The settings for a number of PSAs in this category were night: "John Petross" (1982-83), "Most Criminals Prefer to Stay out of the Limelight" (1986), "He's Moving to Your Neighborhood" (1989), and "Fred McGillicudy" (1989). Each indicates the traditional symbol of darkness as depicting evil in our society. With the darkness clusters concepts of

helplessness and powerlessness, and, with the light, clusters concepts of empowerment to overcome the evil forces as seen in the "John Petross" (1982-83) televised message.

Action. Action here includes power through seeing and recognizing. "How to Catch a Thief" (1981) teaches individual responsibility by training the average citizen to learn to look for and identify a thief. This print ad in its simple presentation reflects the simplicity of just *seeing* the suspicious, criminal activity and then reporting it to the police. A second print ad also emphasizes power through the act of recognition. You can gain power through your act of recognition. Having knowledge is empowering. Whether it is recognizing that arsonists are potential killers or recognizing a thief, as in the print ad "How to Catch a Thief," you gain control by the act of recognizing them for what they are--"an arsonist is not just an arsonist but potential killer" (1981 print ad).

While these print ads were direct and informative, other print ads emphases in the visual presentations were on the criminal's action, not that of the citizen. As a result, the visual's action in the print ads was fear created by the drama and action of the criminal while the television video stressed the action of the citizen. For example in the John Petross print ad, the crook was shown beating down the door. In the television version, the act of beating down the door was followed by John Petross' response and action of establishing a Neighborhood Watch program. In just two years, this action was said to have caused crime to drop 55% and property values to double in that community. Yet the print ad did not stress this in its visuals. It only painted a picture of the negative action of the burglar. Only fear created the drama in the print ad, while in the televised version, action and drama came from John Petross' behavior in response to the violence.

This emphasis on the negative and fear is repeated in the 1989 print ad, "He's Moving to Your Neighborhood." Emphasis is on the criminal action, not on the action of the citizen. In the print ad, the photo catches the drama of a criminal frozen in the action of staking out an elderly woman who is walking alone. Sitting in his automobile, he appears in control of the situation as he sits, waiting to pounce. The same problem appears in the "To Fight Crime in Philly" PSA presented in 1989. In the televised version, the action is transformation in people's lives as pride in their neighborhood returns and as they reclaim the physical space in their neighborhood.

What had once been vacant lots, broken windows, and abandoned automobiles, now have been transformed into gardens and well-lit, clean spaces. The print version emphasized the action of gardening with a modest plant waiting to be planted. The soil and a gardening tool seem to wait to be moved by the viewer of the ad. This print ad emphasizes a living plant growing in good soil, symbolic of a living human being, thriving in a safe community. This contrasts with the previous print ads which emphasized the criminal action and the vulnerability of the elderly citizen.

McGruff. The clusters around the McGruff figure contain the elements of a mentor like those in the "Home Security/Neighborhood Watch" series described earlier. Clusters around the concept of credibility were added in this theme. One of the clusters establishing credibility is McGruff in the role of celebrity, portrayed in the "Cavett" (1986-87) PSA. McGruff gains celebrity status and significance by association with the media figure Dick Cavett. Credibility is established not only through this association, but by mimicking the interview format, which is used to recognize important contributors to our culture. McGruff gains added credibility through longevity in the anniversary celebrations of the Crime Dog and his role in crime prevention of the last decade ("Anniversary: Working Together: This is Your Life, 1990 televised PSA, etc.).

Criminals. The early ads defined the criminal specifically, such as in 1981 thieves and arsonists were listed. The ideas clustering around these print ads were criminals who are weasels, sneaky, and potential killers. According to the 1986 "Most Criminals Prefer to Stay out of the Limelight" print ad, the words clustering around the criminals are *shady* characters who like the dark. The results are "feelings of helplessness and resentment" ("To Fight Crime in Philly," 1989).

Citizens. The descriptions of citizens found in this series of announcements fall into two categories: (a) empowered, highly effective combatants of crime, and (b) vulnerable potential victims. The ratio of PSAs that empowered the individual versus depicting human vulnerability is seven to five. At points, this presented mixed messages, especially in the print ads. While the televised ads have the potential to demonstrate both characteristics, i.e., a vulnerable victim transformed to empowered combatant ("John Petross," 1982-83), the print ads depict one or the other. "How to Catch a Thief" (1981) and "Don't Let the Arsonist Get Away With Murder" (1981) both empower the individual with knowledge. "Tucson Tip-Off" (1990) gives the individuals' names and describes them as "sensitive, highly sophisticated surveillance equipment," implying that these people are highly effective in the fight against crime.

In contrast, others of the PSAs stressed the vulnerability of being human. The 1989 "Most Criminals Prefer to Stay out of the Limelight" print ad depicts the neighborhood as not a safe place and indicates that the elderly woman walking alone is vulnerable with no protection. As she is watched by the thief in his automobile, the elderly woman's vulnerability clearly supports the headline that: "He's moving to your neighborhood because of all its advantages: unsupervised children, idle teenagers, the elderly alone, broken street lights, broken windows" (1989).

Vulnerability also shown in the 1988 "Want to Cut Down Crime? Mind your own Business" print ad. Here the individuals are not faceless statistics or casualties of crime, but real people with real signatures, photographs, and company logos on their employee identification cards. These are not isolated individuals, but real people who are part of a collective whole and who play a vital role in the function of the organization. In this PSA, the employee identification cards are ordinary, everyday items that stand for real-life, vulnerable human beings.

Vulnerability is also found in the 1988 print ad to prevent vandalism. "All dressed up with no place to go" describes the couple set to attend their senior prom. Their formal dress contrasts with the broken windows and graffiti of the stone school building in the background. The broken windows and lost dreams of the couple symbolize the brokenness and vulnerability of human existence. Internal vulnerability is depicted not only in broken dreams, but also in human existence. For example, failure to lock the car makes the individual vulnerable to car theft through his or her own neglect ("You're Probably Wondering Why Your Car Was Stolen," 1989 print ad).

"Children's Drug Abuse Prevention" Clusters and Interpretation

The children's drug abuse prevention PSAs were distributed in 1987-89. Four categories of PSAs relating to this theme appeared on television and radio and in print. All four were aimed primarily at children, with two of the four also geared for parents. The primary purpose of the announcements was to persuade children to say "no" to drugs and to alert parents to the potential danger their children may be in because of drug use and related violence. The key elements of these messages were the setting, action, and McGruff.

Setting. The settings in these PSAs are in two categories. The "Real

Situations" (1989, televised) series of announcements use real-life settings and situations to teach children to say no to drugs. Most of these locations were in a school setting, outside the classroom, suggesting that drug use is a real problem faced daily by children. The print ads in this series are non-threatening. The settings are simple: worried parents ("1 out of 2 Teens in American Has Taken Drugs," 1988) and telephone, writing pad, and binoculars ("Everything You Need to Close Down a Crackhouse," 1989). Clustered around these elements are information about crime prevention and drug abuse that is simple to read and understand.

Other settings in this series were not real-life settings or situations. For example, in the print ad cartoon figures of children holding the McGruff mask ("Saying No Isn't Tough," 1988) are used instead of a photograph of real children. The "Winners Are Losers" ("Memphis," 1987) televised spots juxtaposes an indoor item, a piano, in an outdoor setting of an open field. Children and adults follow the sound of the music, reenacting the image of folklore of the Pied Piper. The "Masks" (1988) spot continues this theme as the children cluster around the piano listening to McGruff. The fantasy world can continue as the children hide behind their McGruff masks. The setting of "Regina" (1988) completes the move from real-life settings and situations. Here the set is composed of changing abstract images and a female singer dressed in a contemporary, exaggerated style.

Action. In the midst of routine actions and settings, school-aged children are interspersed with opportunities for the children to use drugs. Each setting presents the child with enough fortitude to "Just say no" to drugs. The action is the act of saying "no" and walking away from the situation. The everyday routines suggested how easy it was for students to participate in drug use, and simultaneously, how simple statements constitute action to effectively prevent drug abuse. The action in the "Winners Are Losers" (1987) ad is the emotive response to the music. In the "Masks" (1988), the children's action is again following the emotive music, but also, by hiding behind the fantasy world of masks, the children may be able to carry out the action of "Just Saying No to Drugs." However, in the "Regina" (1988) PSA, the action shifts from McGruff's plea to "Just Say No to Drugs" to the singer's exaggerated style, which stimulates the emotive experience of MTV for a younger audience.

McGruff. In this series of ads, McGruff has decreased in visual and verbal prominence in some of the print versions. For example, in the "1 Out of 2 Teens in America Has Taken Drugs" (1988) PSA, he has been relegated to a less significant position on the page and to a much smaller logo. In the others, he has maintained his traditional role of teacher. The primary difference now is that the advice is much less specific. "Just say no" is a generic phrase that is much more nebulous and less easy to apply than simple acts, such as locking doors or turning on lights. McGruff seems to be closer to a light-hearted friend and musician. How well he functions as a mentor regarding crime prevention is difficult to assess.

Overall, this segment of the McGruff campaign begins to move away from everyday items and routine actions. While it is simple to "say no," an apparently clear directive, the problem is in the ambiguity of the individual situations that a child faces. The situation may be as ambiguous as a cocked gun; it may or may not go off, just as a child may or may not have the ability in that moment to say no. Overall, these messages move toward a fantasy world of emotional and experiential settings.

Overall Interpretation of Primary Clusters in PSAs

Overall, the PSAs are visually uncluttered and straightforward. The verbal messages are presented in a concise conversational tone. A recurring idea

throughout many of the announcements is a stamp of ownership--*your door, your house, your child, your community*. This ownership establishes the individual's identity and membership within the local community. This identity within the community is combined with personal action and responsibility to create a central focus revealed through the primary themes of the major clusters--the settings, characters, and actions.

Setting. For the most part, the clusters surrounding the settings present the lifestyles with which traditional American families can identify. The furnishings are comfortable and the decorations familiar. This familiarity also creates a stamp of ownership. The lighting used in many of the settings switches from darkness to light. This parallels visually the transition that can occur in communities as individuals follow the prescribed crime prevention behaviors so that their neighborhoods are dominated by light and goodness, not darkness and crime. The light within the settings and the stamp of ownership, establishing the individual's or community's "territory" (e.g., "Mimi Marth," 1981), combined with the concepts of prevention so that the overall settings are not those of fear, but those which remind individuals of their control and power of the environment.

Characters. The characters presented in all the PSAs are defined clearly and consistently: The perpetrators of crime who will destroy the viewer's or listener's home, family, or community; the mentor who is the detective-dog McGruff; and the potential hero, the average citizen who is at risk. The perpetrators of crime are not always shown in the PSAs, but they are always alluded to. When shown in PSAs like the "Gilstraps" (1981), they are portrayed as normal workers moving furniture. In the "John Petross Neighborhood Watch" PSA (1982), they are portrayed in a more violent fashion. The violence is kept brief, and the focus quickly shifts to the cooperative action of members of the community as they organize themselves to monitor their neighborhood. For the most part, the criminals are presented as opportunists--"all crime needs is a chance." They are looking for an easy way to invade the individual's home or attack a member of his or her family. For the most part, they are persons who like the dark--"lights make burglars nervous." They are persons who prefer uninhabited, lonely places and avoid communities and homes that look "lived in."

The major character of most of the PSAs is McGruff, the Crime Dog. Wearing a detective's garb, this main figure embodies two major concepts. The first reflects the common understanding of a dog as a person's "best friend" and "protector." He is fearless, courageous, and loyal. The dog's trench coat reminds the viewer of detectives who move from the world of light to the shadowy world of crime seeking good for the community as he removes the potential for crime. Even with such a mission, McGruff is always portrayed as being *human*. For example, in the "Stop a Crime" PSA (1980), McGruff's penchant for sweets and concern for gaining weight--"Fudge brownies! And me on a diet"--place a common personal concern against a broader, more threatening social concern of crime. The result is a sense of identification between viewer and McGruff.

The detective dog's roles are clearly defined as those of teacher and advisor, and McGruff is the one who consistently provides important information about steps for protection behaviors. McGruff is portrayed as a wise person who knows the ways of the world and who also advises the audience in a gently chiding manner. This authority figure has the characteristics of an all-important mentor--one who knows the answers, understands both sides, combats evil, and cares for those who he guides.

The third group generally portrayed in the PSAs is the potential heroes. These are the people who have within them the power to prevent crime. The potential

heroes are portrayed as average citizens who are sometimes forgetful, "It's a funny thing. A lot of people do that. . .they forget." The citizens live, for the most part, in communities where they can trust, or learn to trust, their neighbors and can have a common concern for *clearing* their neighborhoods of crime. This is enacted through active neighborhood cooperation, not just passive acceptance of crime as the accepted standard within the community.

In the PSAs, these citizens have the potential to act against crime if they believe in and follow the simple steps advocated by McGruff. As they prevent crime in their own neighborhoods and lives, they can become heroes. This goal, to "take a bite out of crime," is a noble one that reflects the individuals' struggles to make their own communities better places to live. The overall portrayal within the PSAs is that of a dominate mentor who provides sage advice for individuals. As a result, they have the potential to control what happens and improve the level of safety and security in their communities.

Action. The clusters within the PSAs advocate four important categories of action: (a) increased awareness of crime prevention techniques; (b) changes in attitudes regarding crime prevention, personal involvement in and personal responsibility for crime prevention; (c) specific behaviors that can be implemented to prevent crime; and (d) creation of stronger community ties to create healthier, crime-free neighborhoods.

The recommendations regarding these categories of action are simple, logical, easily remember, and accomplished. For the most part, they are from an offensive position, except for the defensive behaviors portrayed in PSAs like "Mimi Marth" (1981) and "John Petross" (1982-83). The underlying assumption is that if citizens will follow the advised actions, they will gain control over their environments by preventing crimes of convenience.

Because of the clarity of information and instructions, the four categories of actions work together to motivate citizens to pursue knowledge of crime prevention and enact them in their communities. Primarily they function to raise awareness of potential danger, the first category of action. They assert that by being aware of potential crime, the individuals can begin to make changes that impact their society. Through specific actions, they can make their families, homes, neighborhoods less susceptible to violence. Secondly, these kinds of assumptions about the influence of the individual encourage more positive attitudes toward the ability of citizens to be personally involved in the prevention of crime. This position strengthens individuals internally and empowers them to act with confidence and hope.

The third action entails specific behaviors. A few of these simple, yet effective actions, include "lock your doors," "turn lights on and off," and "don't use drugs." All behaviors presented in the PSAs are clear and concise. In addition, each PSA specifically encourages information-seeking action: "make it your job to learn about crime prevention. . ." and "write to. . .[address given]."

These three actions culminate in community emphasis, the fourth category. The announcements help create stronger community ties to protect the home and family. These may be addressed indirectly, as in the "Real Situations" (1989) PSA, or directly, as in "John Petross, Neighborhood Watch" (1982-83). The community involvement may be simple, such as asking a neighbor to "keep an eye on your house" ("Stop a Crime," 1980), or more complex, such as renovating old buildings and cleaning vacant lots ("McGruff Files, 1990).

The visual rhetoric of the PSAs creates a world view that is simple and basic. The announcements show a rational approach for organized actions in order to slow down the creeping prevalence of crime within neighborhoods. This enhances self-responsibility, a common theme in the idealism of America.

Furthermore, the PSAs address a common human desire to succeed. Success can be achieved by following the advice provided in the announcements. These recommended activities empower the individual so that the average citizen can be the hero who successfully acts in his or her own territory, removing crime and replacing it with a safe haven for family and friends.

The ideology of the McGruff PSAs shape the audience, but how members of the audience selectively appropriate what they most want from the PSAs, i.e., how the audience assumes the PSAs and interprets them, is more important. In this sense, the announcements become important resources of the populace. The most significant contribution of the PSAs is that through them the audience can reinterpret its history and reflect its own social relationships. What becomes important is how the individual interprets his or her role in the community and interprets the causes and methods of elimination of crime.

Simultaneously, creators of PSAs must always recognize that mass media ads serve not one audience, but several. These varying constituencies are constantly adapting the mediated messages to their specialized needs based upon the individuals' interpretations of their own community histories and relationships. This will be reflected in how each community enacts the recommended actions of the PSAs and assimilates the Crime Prevention programs to meet its specific needs. Any changes, along with the individuals' interpretations of their roles in and histories of their communities, will provide recommendations for changes in future crime-prevention campaigns.

Intertwined with the recognition of the different constituencies is the understanding that the audience is an active participant in the mass communication process. The McGruff ads assume that the audience is not passive; rather they advocate personal activities and responsibilities. The PSAs push the audience beyond the realm of simply participating in the media process. Instead, the audience is encouraged to perform specific behaviors within local neighborhoods. This shifts the relationship between the sponsor and the audience from a potentially paternalistic one (i.e., one in which media experts and law enforcement agencies care for a community) to one that is more fraternal (i.e., one in which community effort is shared by media experts, law enforcement agencies, and local citizens).

Conclusion

Overall, the McGruff "Take a Bite Out of Crime" PSAs appear as messages to have communicated with their audiences in a fresh and memorable way. The PSAs have met the first primary goal of providing content to potentially increase the *awareness* of crime prevention among audience members. For example, the "Real Situations" (1989) allowed the audience to become aware of impending dangers to children. PSAs like the introductory McGruff announcement in 1980 provided a basis for *reinforcing* existing behaviors, such as locking doors and turning on lights. *Motivation* among viewers could be encouraged by such PSAs as "John Petross" (1982-83). Here a member of the community actively fought against crime, as he adapted and implemented a Neighborhood Watch program to meet his local community needs.

Specific aspects of the campaign that would seem to aid in raising awareness, reinforcing existing behaviors, and developing motivation among viewers relied on two important elements: (a) emphasis on the individual and his or her community and (b) audience identification with McGruff. The PSAs throughout all fifteen phases of the campaign consistently have emphasized the importance of the individual by giving many of the messages personal tones such as *You* can help prevent crime. *Your* door, *your* house, *your* child, and *your* community established the viewer's sense of identity with and ownership of their homes and

local communities. In the process, the viewers can gain a sense of identity with the creators of the crime prevention messages. This identity can help them feel that "We--all levels of our society--are all in this together." Additionally, the PSAs have demonstrated an appreciation of the individual's concerns, fears, and problems regarding crime and crime prevention. Throughout most of the campaign, the PSAs recognized viewers as competent individuals who wished to assume responsibility for changing their neighborhoods.

In keeping with the concern for developing crime prevention through community efforts, the McGruff campaign has been based on the premise that as local neighborhoods build stronger ties, a new sense of community will emerge. In the process, it is intended that individuals will feel they have some control over their lives, as well as begin to care--about each other, about the neighborhood, about their schools, and other institutions. The campaign reinforces that this sense of caring can serve as one of the best answers to crime, suggesting that the solutions are within the community and that by working together, individuals in the community can make a difference.

The second important element has been McGruff. The Crime Dog was the central figure in the situational PSAs, and his personality created an important ethos that was essential to the success of the announcements. Over the years, he has been described as "believable, credible, trusted," and he has been established as a "role model" with whom audience members could identify. He lighted the heavy, emotional topic of crime and crime prevention. He reassured, encouraged, and supported individuals and communities. He was interesting and humorous, but at the same time always serious. But most of all, McGruff was always informative. Throughout, McGruff portrayed a sense of confidence as he offered positive, simple information that people could easily remember and steps that they could readily enact.

In summary, this analysis provides insight in the development of the campaign by outlining the varying visual and verbal rhetoric found within the PSAs and how they reinforce or detract from the overall goals for the McGruff effort. Specifically, the interpretation reveals how the PSAs may create public awareness; encourage public commitment to preventing crime and drug abuse, and building safe communities; and motivate citizens to take positive actions to strengthen social bonds and increase public pride in their community. The manifest content of the McGruff campaign aims to focus public attention on the vital issues of crime prevention and mobilize the public to deal with those issues. Most of all, these announcements appeal to what is most human in all of us, the desire to take care of our own. This suggests that these PSAs and their ensuing world views may be serving a ritual purpose as much an informative one for the audience.

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IMAGE MANIPULATION: THEN AND NOW

by
Ronald E. Sutton

Image Manipulation Then and Now examines the role of image trustworthiness in our 20th century society. The argument is a simple one: Photographic imagery, both still and motion, has always lied (Goldsmith, 1991). The question in the age of digital cameras is whether the lies can be detected. That is a difference--lying with a trace, and lying without a trace. Art Curator William M. Ivins wrote "The 19th century began by believing that what was reasonable was true, and it would end up by believing that what it saw photograph of was true" (Zelle & Sutton, 1991). At the close of the 20th century that belief needs to be challenged.

The foundations of science, law, history, and anthropology are entwined with the "truth" of photography. As is pointed out in a number of scholarly works (Barnouw, 1981; Jaubert, 1989; Mast, 1984; Rosenblum, 1984), this is a misplaced trust. The images of photography were manipulated almost from the moment of their discovery. The early technology of photography simply could not accommodate the dark tones of the land and the bright tones of the sky in the same shot. This was solved in the darkroom by stripping two different photographs together. Sometimes the clouds or other details of the scene were painted in on the print (Zelle & Sutton, 1991). Also, what began as an attempt to remove specks of dust, gelatin flakes, broken glass with paintbrush and paint soon gave way to erasing wrinkles, blemishes, and ultimately unpopular people from historic photographs (Jaubert, 1989).

In the hands of such photographers as Oscar G. Rejlander and Henry Peach Robinson, totally fabricated images were produced involving as many as twenty negatives (Zelle & Sutton, 1991). This trend in photographic art has continued to the present day in the works of such artists as Jerry Uelsmann, Cindy Sherman, and Nic Nicosea. The blending together in the studio and darkroom of images not found in actual scenes from life has been a regular feature of modern photography in both art and advertising.

Despite the weight of authenticity placed on them ("if it's a photograph, it must be true"), it is quite clear from observing the historical record that the photographic record has been manipulated by those behind the camera or in the darkroom. Alain Jaubert (1989), in this book "Making People Disappear: An Amazing Chronicle of Photographic Deception," underscores how this manipulation of photographs for political propaganda reached its apex in the 20th century. In this excellent study Jaubert categorizes the favorite techniques of the photo manipulators:

Retouching

Using a brush and/or paint to remove an imperfection in the print and/or negative.

Blocking

Painting out figures or details from the actual site of the photograph often to idealize a figure or change a historical context.

Cutouts/Collage/Montage

Cutting out a figure from the background and placing it in a new setting or with a new group. Non-matching shadows often give this technique away.

Recentering

Cropping or framing a picture in re-photography or printing to exclude

unwanted figures or information at the sides and edges.

Effacement

Slicing a figure or area out of the center of a picture, then joining the edges, and retouching to smooth the seam or fill in the blank. (Sometimes the blank is left to warn those who might challenge the regime in power.) Difficult to do without leaving traces seen by the trained eye (Jaubert, 1989; Zelle & Sutton, 1991).

This catalogue includes only those techniques that are used on an already existing historic photograph. It does not deal with the question of distortion that is built into the photographic *choices* used in creating the photo in the first place. These include choices of:

- subject, costume, make-up,
- film stock,
- lens: wide angle, normal, telephoto,
- angle: high, low,
- aperture/light,
- shutter speed and shapes and depth of field,
- type of shot, long, medium, close up,
- framing of the subject.

Many persons have a quite limited understanding of how these factors have shaped the historical photographic record since the medium's invention in 1939.

Motion Pictures

Similarly, since 1895, projected motion pictures have shared with still photography the burden of appearing to be an accurate record of actual events. However, they share all the above-listed *choices* with their forerunner, still photography. Perhaps they are even more illusionary for they evoke the sensation of watching motion, when in actuality they are merely the projection of successive still images. These occur rapidly enough so that, thanks to the phenomenon of persistence of vision, the image of one picture blends with the next at a rate of some 24 frames a second to render a convincing illusion of motion.

From the beginning of motion pictures, special effects have also been present to reshape the reality that we watch. People appear and disappear by stopping and starting the camera; whole towns and distant vistas are added to film via matte painting on glass; miniatures made to scale, coupled with authentic mechanicals, fool us into thinking that things are happening on screen that are impossible, from "King Kong" to "Jurassic Park" (Fielding, 1965).

In the area of narrative fiction films this is hardly a problem since few questions of historicity are involved; however, when we turn to the documentary film form, or educational film, we come upon similar or parallel devices that are used to portray historic events. Many fiction film techniques such as reenactment to achieve matching action, directing, scripting, actors, etc., were used in the documentary field up to roughly 1960, discarded for a decade or so, and now have found their way back into post modern documentary production (Barnouw, 1981).

Traceable Fakery

Most of what has been discussed to this point can be identified by a trained and visually literate eye and mind. Books on the cinema (Cheshire, 1979; Giannetti, 1987; Mast, 1984; Monaco, 1981) abound with information about how illusions are created in fiction film. The documentary field has also been revealed to the world through scholarly work as well (Barnouw, 1993; Barsam, 1993; Ellis, 1989).

Even this quick overview (Zelle & Sutton, 1991) illustrates that even though the public may follow Oliver Wendell Holmes in viewing photography as a "mirror with a memory" the public needs now to know that the mirror was always cracked, the memory was faulty, selective, and manipulated, a construct of whomever was holding the 'mirror.' The public needs to know this about the past, for the present and future will demand even more skepticism when it comes to trusting the photographic image.

Computerized Imagery

With the advent of the computer and its related technologies the world of photography has been revolutionized. Whether reworking existing images, creating new ones on program command, or capturing fresh images through a new breed of electronic cameras, there is little question that images have become even more untrustworthy than ever.

This is all done through digitization. This is a process in which the photograph is scanned by machine and broken down into tiny picture elements called *pixels*. Each pixel is analyzed for information (shape, color, brightness, etc.) and assigned a numerical code. Then the computer can make a number of changes before storing the final image on a magnetic disk:

- retouch spots and scratches,
- brighten or change color,
- add new elements to the picture; move or eliminate existing material,
- extend backgrounds to fit page format, fill in new holes caused by removals,
- draw in shadows to make a common light source,
- turn images in perspective or cast them in three dimensions (Zelle & Sutton, 1991).

This started as a very high end operation costing thousands of dollars and involving such names as Scitex, Hell, and Crosfield. Now, it can all be done on desk top personal computers, especially Photoshop by Macintosh.

The values to the entertainment, advertising, and mass communication industries are immeasurable in terms of efficiency, economy, and effect. Clearly there is much that is beneficial in this revolution that is still creating more wonders for us to absorb each year.

But clearly there are dangers here as well. Some of these serious concerns were addressed at a seminar sponsored by The Annenberg Washington Program in Communications Policy Studies of Northwestern University, held December 10, 1991 in Washington, D.C. Don E. Tomlinson (1993) has created a significant monograph entitled "Computer Manipulation and Creation of Images and Sounds: Assessing the Impact" based on this seminar.

I quote at length from the Executive Summary of the seminar and monograph because of the clear note of alarm it sounds and the probing questions it raises.

> Technological change in mass communication is occurring so rapidly it is impossible to stay completely abreast of even the most significant changes, much less their meaning and possible ramifications. Some of the changes may seem evolutionary. Others, however, are revolutionary, such as the switch from analog to digital technology. With the coming of the computer, the change simply was inevitable.
>
> This transition has two major and interrelated facets. One has to do with the means of communication. The other, and perhaps more important, has to do with the content

> of what is to be communicated because digital technology makes possible the easy, quick, and undetectable manipulation of images and sounds
>
> The potential effect on journalism is profound. How will our lives change when we can no longer trust the images and sounds provided to us by the news media? How will our lives change when government and politicians and historians can manipulate the images and sounds we see and hear?. . .
>
> The potential legal ramifications are also immense. Given the degree of digital visual and aural manipulation that could occur, especially in the news media, there are implications of the First Amendment. Copyright law as we know it today could prove to be wholly inadequate as a means of protecting ownership interests in images and sounds. Tort law implications arise in relation to libel, false light privacy invasion, product disparagement, and right of publicity, among others. There will be considerable contract-law implications. Will images and sounds continue to be admissible evidence once the product of recorded communication exists only in the digital domain?. . . (Tomlinson, 1993)

The changes that Tomlinson outlines are noteworthy and serious--an agenda for educators of all types. However, what I have tried to point out, in the earlier pages of this paper (and in earlier publications done with my colleague Ann Zelle) is that we should help people see that their faith in the simple veracity or trustworthiness of image communication has *always* been misplaced. In the terms of present day analytical scholarship especially related to media literacy, it is important to assist all persons to understand that media images are constructs. They are created for a variety of reasons, one of which, in our society, is to make money for their creators. Truthfulness and reliability may enter into the equation but at a lower priority than many laypersons would realize.

The task of the visual educator is to help learners see these aspects, to help them to become visually literate. Being skeptical about how images are created and for what reasons they have been constructed should be a fundamental tenet of all modern curriculums in all fields, in all professions.

Some may quarrel with the term skepticism. That may not seem to be an appropriate element in helping the young understand their world. Should we make young children *skeptics* from the start? Can cynicism be far behind? I am afraid, for the time being, my answer is a vigorous yes and the sooner the better. Distinguished media scholar, Raymond Fielding (1987), who attended the Annenberg Seminar, puts the issue this way writing in "Newsfilm as a Scholarly Resource: Opportunities and Hazards:"

> The problem of editorial distortion and misrepresentation is one with which we have had to deal for many years. However, a far more serious problem faces us in our technologically elegant future. Computer hardware and software now exists for the unlimited modification and digital retouching of still and moving picture photographs and in a manner which is undetectable.

It is the undetectable part that is chilling. This is related to the digital wizardry of the computer. In analog copying and modifying the copy print exhibits a generational loss from the original. In digital transfer no such loss is detectable. Here is the way Tomlinson (1993) describes it:

> In digital videotape editing, there is absolutely no loss of quality from generation to generation because the source signal is not being transferred

> to the resulting videotape, as is the case with the analog technology. The resulting videotape, through the digital process, receives binary computer information; it is a mathematical recreation, not a transference. And since it is purely a mathematical process, the source image can be altered fundamentally and undetectably before and/or during the reproduction. (p. 10-11)

What this means is that there is no original negative/print/tape against which to compare the altered version.

The possibilities for mischief, historical, political, legal, and cultural, are legion. Suddenly, a long hidden photograph showing Lee Harvey Oswald meeting with Fidel Castro could become a part of the historical record, lending credence, if not proof, to that particularly conspiracy theory about the Kennedy assassination. Here is Tomlinson's (1993) well-chose scenario:

> The 1981 footage of the Reagan assassination attempt, for example, might be amended as follows:
>
> 1. a few representative frames amended by the removal of the other individuals from in front of the President when he was shot;
>
> 2. additions in those frames to show what an unobstructed view of Reagan getting shot might have looked liked; and
>
> 3. the computer then filling in what the remaining frames would look like given the human amending already done.
>
> Once any such amendings were completed, the human editor would command the computer to review, refine, and reform any frames that did not look photographically real. The entire process would take only a few minutes. (pp. 12-13)

Sounds Also Can Lie

It is clear that sound reality is in every bit as much danger of modification and invention as image reality. The same digital techniques can be used to alter, or *sample* or *clip* sound. While some sections of our society may care little when this remains a battle between record companies over *digitally sampling* rap stars, the fact that the President of the United States, or Yasser Arafat, and Yitzhak Rabin could be made to say something with their own voice which they actually never said is quite disturbing at this delicate point in the Middle East peace process.

Reaction to Manipulation

Moving to the area of application and implication it is interesting and encouraging to note the shock with which news of digitilization of photographs is met when exposed to the public:

- *TV Guide's* gaffe in placing Oprah Winfrey's head on Ann Margaret's body (Zelle & Sutton, 1991).
- The *National Geographic's* rearrangement of the pyramids for its February 1982 cover (Becker, 1991; Tomlinson, 1993; Zelle & Sutton, 1991).
- The *Time* 1988 special issue on the 150th anniversary of photography that pledged it would never digitally manipulate a photograph, yet contained a digitally manipulated image of Mary Decker on its cover and inside page (Tomlinson, 1993).

In both his writing and personal lecture and interview, freelance photographer and journalism professor Tony Kelly indicates that the profession is being hard-pressed to control the easy manipulation of images. When is it innocent--taking out the offending antenna that seems to spring from Mary Decker's

body, and when is it catastrophic--albeit amusing--when a picture of a swimming pool was digitalized back to blue from red because the computer folks did not know it was to accompany a story in the Orange County *Register* about vandals dumping red dye in a local pool? (Becker, 1991; Kelly, 1992).

Photojournalism at Risk

Many feel that photo journalistic integrity and credibility may be at stake (Tomlinson, 1993).

> If photographic reality were defined by a consumer of photojournalism, the definition might be: the images presented accurately represent the object of the photography as recorded and subsequently disseminated by mass communicators. Because photographic reality in photojournalism translates to credibility, it is an essential ingredient of any mainstream American journalistic enterprise.

Many scholars, including Tomlinson (1993), feel that photo-journalistic credibility will be seriously challenged if not completely undermined by the new digital revolution.

One of the devices that may hasten this decay is the electronic camera.

Electronic Cameras

Sony announced the Mavica in 1981. A working prototype was demonstrated and Mr. Murita of Sony stated that this device would revolutionize photography (Edwards, 1993; Becker, 1991).

Canon joined the field and developed its video still camera by 1986. It presently markets this equipment actively (an ad for the system was contained in the United Airlines Flight Magazine I read on the way to the Visual Literacy Symposium in Delphi, Greece [*Hemispheres*, June 1993]), (Edwards, 1993).

Sony now has the ProMavica which stands for Magnetic Video Camera. This uses analog images not converted immediately to digital. This camera lists for $9,000 (Edwards, 1993).

Kodak's DCS 100 and 200 digital imaging camera uses a computer chip. Here is a consumer oriented blurb from *Byte* magazine (1993):

> The Kodak DCS 200ci shares a lineage with Kodak's original electronic camera, but some important advances distinguish it. Its price comes in at under $10,000, yet it provides the same resolution and quality as its $25,000 stablemate in a smaller, consumer-oriented package. Pictures are stored on an internal hard drive and downloaded directly to a PC or a Mac. Operating costs are virtually eliminated: There's no film to buy and no need for a high-quality scanner. Results are almost instantaneous, and in an ecology-conscious world, there's no film or chemical wastes to worry about.

An article by Howard Eglowstein (1993) in this same edition of *Byte* gives an extensive test comparison of the Sony MVC 7000 and the above-mentioned Kodak DCS 200ci. They are both evaluated as quick, efficient cameras that take instantly reviewable pictures without film but with lower resolution than film.

Tony Kelly (1993) explained that they do not work well for full page glossy magazine work: "You can go up to three column width but blowing them up beyond that is a problem as to sharpness, resolution, and picture quality."

A final entry in this field is the Leaf Digital Studio Camera. This is a camera back which attaches to conventional studio cameras such as Hasselblad, Sinar, Cambo, and Mamiya Rx-67 and feeds the images into a Mac computer. Developed and connected to Scitex, Leaf is centered

in the Boston area (Leaf, 1993; Schlowsky, 1992).

This system is used primarily in studio work with advertising and I suspect causes little problems due to the low credibility rating of ad photography historically.

Conclusions

What I have tried to argue is that image manipulation is not something new. It has been present since the birth of both still and motion photography. The element that is tricky is the *without a trace* and the *ease of accomplishment* factors, both of which I have tried to highlight in my presentation.

There is little question that there is a need for broad, candid, and simple information sharing, for education of the most basic kind. There is also a need for more rigorous professional standards. Kelly (1991) speaks of this in the June 1991 edition of *Editor and Publisher* when he quotes one of the protocols developed at the Poynter Seminar on Journalistic Ethics:

> Manipulation of (documentary and news) photographs, which alters the content or context, is unacceptable. Electronic or manual methods should be used only to assure the highest reproduction quality of the photograph. Photo illustrations are conceptual images and should be (easily) distinguishable from documentary photography.

Karin Becker's (1991) study of the pages of *News Photographer*, the official monthly publication of the National Press Photographers' Association, reflects the same concerns that the credibility of the press photograph be salvaged through applied professional standards and guidelines. However, many feel this simply will not work in a profession that, unlike Law and Medicine, is not a profession with recognizable standards for entry and ouster.

What is really needed is education of the consumer in visual literacy and media literacy. Ray Fielding suggests some of those in the media might help with this vast educational task (Tomlinson, 1993):

> . . .they should make some exciting programs about the new technology itself so as to bring the audience into the process; thereby making the audience aware of the problems of the information communicator and of the historical communicator: In this way it is the audience who would in the end decide what will be done with this exciting new technology that has been made available to us (Tomlinson, 1993, p. 57).

We can use the media to teach about the media. We can use the media or let the media use us. One of the tasks for the 21st century in the area of Visual Literacy is to teach people about Image Manipulation: Then and Now.

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IN-SCHOOL COMMUNICATION SYSTEM AS A MEDIUM FOR MEDIA EDUCATION

by
Yasuo Takakuwa

Review

In Japan, economists were interested in the instructional use of in-school communication systems (building-wide PA system and CATV) after World War II. They began to discuss the educational virtues of it. Consequently, there has been a steady development in the number of hardware in schools. In spite of this tendency, however, it is difficult to evaluate the success and the extent of their use in the educational purposes, though some pioneering schools launched the instructional utilization of these systems in their everyday practice.

Even so, we need to review the whole picture of the use of in-school communication system to figure out the future development of media education in this country. That is because in-school communication systems are quite useful when we intend to promote media education in schools. It is a good opportunity for children to learn how various media work in society by producing and disseminating their own programs for other classes within the school.

That is why this study was done. The problems and methods used are as follows:

1. What is the significance of in-school communication system according to some theoretical literature?

2. How is the accommodation with the hardware in schools achieved, considered from the Ministry's survey?

3. What is the present situation of the practices in elementary schools, by observation of a questionnaire survey?

Educational Significance of In-School Communication System--Pedagogical View

After the Second World War, Japanese education turned to stressing on children's autonomous study, for which the observations, study trips, experiments, surveys, and other activities in and out of campus were highly recommended as teaching methods. Using in-school communication systems was also among them.

On the other hand, using in-school communication had its roots in school broadcast since before WW2 in the sense of using receivers in the classrooms. People thought, however, that the important nature of using in-school broadcast was a new way of autonomous and active study for children.

The importance of in-school communication system as an opportunity for children's autonomous and active study can be found in the following points, they said:

1. They need to find the topic they want to present to the audience.

2. They have to collect and organize the materials for the program.

3. They must decide the presentation format most suitable to the content.

Secondly, administration of the in-school communication system by children themselves can be seen as an effective way of developing their ability in cooperation and sociability. Main points are as follows:

1. During production and dissemination of programs, they have to take part in collecting materials, writing scenarios, various technical allotments and announcements in order to pursue their task cooperatively toward success.

2. In-school communication activities will be enriched by cooperation with local community and other schools.

Finally, in-school communication system can be seen as *mass media within a school*. It is possible for children to consider this as a chance to learn what mass media is. Therefore, this is a place for media education, because participation in production and dissemination makes children change their standpoint from listening-receiving to sending-creating. This shift of standpoint causes effective learning of media.

1. Children can learn vividly through their own experiences how mass media works and how the information conveyed by mass media is formed by expressive and creative activity, and acquire the ability to perceive information accurately.

2. The interchangeability of standpoints from receiving to creating and vice versa, and the close relationship between the two gives them the chance to often discuss media and information with each other. This, again makes kids creators and active receivers at the same time.

As a matter of fact, the concept of in-school communication system as one of the opportunities for media education is not yet widely understood. Even those who are practicing in this way tend to develop only the technical ability in children. The only example of using in-school communication system for media education is the practice at Seijo Elementary School in Tokyo which has kept its tradition since the late 1940s.

Growth of In-School Communication System in Elementary Schools

The supporting apparatus for in-school communication system has grown in number since the end of WW2. At the beginning, the Allied Forces put special effort on preparing schools with radio receivers to making use of school broadcast for their purpose of retraining of Japanese teachers.

According to the survey administered by the Ministry of Education, Science, and Culture since 1972 (1972, 1977, 1980, and every three years thereafter), building-wide PA systems were already installed in almost every school as early as 1980, while CCTV has also grown very rapidly. (See Table 1.)

Table 1. Diffusion of Rate of Apparatus in Elementary Schools

	PA System	CTR	CCTV	VCR	V camera
72	93.9%	54.2%	10.5%	16.7%	12.9%
77	97.6	92.2	22.6	24.9	6.5
80	98.13	97.40	31.49	53.70	26.77
83	98.32	98.74	43.60	80.08	58.44
86	97.81	98.51	52.32	91.14	73.21
89	98.24	97.49	59.22	96.11	80.67
92	98.59	97.47	63.04	96.93	92.87

PA System: Building-wide PA system
CTR: Cassette tape-recorder
V camera: Video camera (Color), * including B&W

Moreover, tape recorders, VCRs, and video cameras have been growing in number, too. Video cameras, for example, experiencing upgrading in capability and model changes, reached to more than 90% in about 1990. It is easily seen that Japanese schools are well-equipped with enough hardware for making use of in-school communication system.

Present Situation of Using In-School Communication System: A Survey

We administered a questionnaire in January 1993 to disclose the present situation of using in-school communication system in elementary schools in Japan. The results are shown

in Table 2.

Almost all schools are equipped with audio and visual receiving apparatus. In-school communication practice is done through these systems mostly during recess between class periods. Programs consist of announcement and direction, music, signals, and other types mainly proposed by teachers. However, some by children are also included.

In most schools local productions are seen, half of them produced by the broadcast committee of the children's body. There are teacher's and children's groups for production and dissemination. In case of the children, the group is a part of the pupils government.

Efforts are placed on making in-school communication system attractive to pupils by familiar programming, programming for specific grades as targets, introducing attractive formats of presentation such as quizzes and interviews, and producing programs based upon questionnaires and requests.

Concerned teachers feel the problems of in-school communication. They include "mannerism makes kids dull towards it," "teachers suffer from difficulty in sparing their time to guiding children's activities" and "need for better apparatus." One teacher, however, stressed on the necessity of considering how it would be possible to develop children's appreciation ability through using in-school communication system effectively.

Conclusion

There exists a way of thinking where in-school communication system is considered as one of the media education opportunities since its beginning in the early postwar period, while quite a few schools have kept their progress ever since in spite of the quantitative development of apparatus. It is evident that some difficulties exist in pursuing practices creatively even at present. Nevertheless we can find some teachers, struggling towards making better use of the system for media education, who are aware of the importance of it in the present social and educational circumstances.

Table 2. Results of Questionnaire

% of in-school communication system use	100(no=20)
% of audio receiving system use	100
% of visual receiving system use	95
Contents of the Programs (no=74)	
announcements and direction	17.6
story telling	16.2
music	13.5
news of the season	10.8
repeat of school broadcast programs	10.8
signals and signs	5.4
news topics	2.7
community report	2.7
drama	..2.7
teacher's speech	1.4
presentation of research results	1.4
opinion presentation	1.4
others	5.4
Sources of the Programs (no=34)	
broadcast programs	14.7
local production	55.9
programs on sale	29.4

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Disseminating Time (no=20)	
recess (before class, intermission, & after school)	95.0
class hours	5.0
Purpose of Dissemination (no=31)	
enrichment of instruction	32.3
opportunity of extracurricular activities	25.8
channel of information offerings	41.9

Ways to Attract Pupils to In-School Communication
pick up familiar topics
programming by request and questionnaire
specification of audience
promoting children's activities
variety of programs (quiz and interview)
guiding mechanics operation
utilizing school events
Problems & Difficulty in In-School Communication
mannerism makes kids dull toward it
teachers cannot afford time for guiding children
guiding children to develop appreciation ability by production of programs
training of teachers for leaders
consideration of suitable environment for autonomous management by children
need for new equipment for better activities

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A HYPERMEDIA COMPUTER-AIDED PARASITOLOGY TUTORING SYSTEM

by
Georgios Theodoropoulos and Vassili Loumos

Introduction

The teaching of parasitology is a basic course to all life sciences curricula and to date no computer-assisted tutoring system has been developed for this purpose. By using Knowledge Pro®, an object oriented software development tool, a hypermedia tutoring system for teaching parasitology to college students was developed.

Generally, a tutoring system contains a domain expert, a student model, a pedagogical expert, and the user interface. In this project, particular emphasis was given to the user interface design and the expert knowledge representation.

The system allows access to the educational material through hypermedia and indexing at the pace of the student. The hypermedia access is facilitated through key words defined as hyper text and objects in pictures defined as hyper areas. The indexing access is based on a list of parameters which refers to various characteristics of the parasites, e.g., taxonomy, host, organ, etc. In addition, this indexing access can be used for testing the student's level of understanding. The advantages of this system are its user friendliness, graphical interface, and its ability to incorporate new educational material in the area of parasitology.

Computer assisted instruction is a recent development in the area of software engineering and refers to systems that can tutor humans. Their widespread use is due to their advantages which are: individualized and self-adjusted level of material, remedial or accelerated process, immediate feedback with explanations, consistency of teaching, updated material, no location restriction, and variety of presentations (Van Horn, 1991).

Various interactive computer-assisted tutoring systems have been developed in the area of veterinary medicine (Angarano, 1992; Eljack, 1992; Lalier & Beauchemin, 1992; Kazacos, Roesel, & Harrington, 1992). The operation of these systems is based on hypermedia technologies, while the man machine communication is facilitated by a graphical user interface.

Hypermedia is an environment for handling text and graphic information enabling the user to switch between various topics in a non linear fashion by following the paths defined by related ideas (Bielawski & Lewand, 1991). A graphical user interface (GUI) makes extended use of metaphors in a visual display in order to communicate graphical information (Laurel, 1990).

The teaching of parasitology is a basic course to all life sciences curricula but up to now no computer-assisted tutoring system has been developed for this purpose except a limited application of Hypercard® for teaching parasite life cycles (Wharton, 1990).

By using Knowledge Pro®, an object oriented software development tool, a hypermedia tutoring system for teaching parasitology to college students was developed. This object oriented system can be used by the student not only as a self-learning or auto-evaluation medium, but also as a reference tool by applying Boolean search on indexed data. Boolean search is based on Boolean algebra (Lidsay & Norman, 1977), where key words are used to establish a filter for search in text data.

Description of the Program

The program was developed by using Knowledge Pro®, an object oriented software development tool and was designed to meet four objectives: Knowledge incorporation, tutoring, indexing of key words for Boolean search, and random generation of quiz questions with instant scoring.

Knowledge Incorporation

Educational material in the form of text is incorporated in the system as ASCII files. This material is divided in parts, chapters, sub-chapters, and so on down to the level of the parasite which is referred to here as the knowledge set. Each knowledge set includes information on a given parasite arranged as a list of parameters describing various characteristics of the parasite, e.g., hosts, life cycle, pathogenesis, etc. The division of the educational material follows the taxonomic classification of the parasites, e.g., phylum, subphylum, class, etc. (Kassai, Corder del Campillo, Euzeby, Gaafar, Hiepe, & Himonas, 1988). Therefore the knowledge of the system consists of sets each of which has the same construction (parameters) regardless of the parasite. The knowledge sets are related with each other and these relationships correspond to the taxonomic classification of the parasites making an inverse knowledge tree (Figure 1). This arrangement allows the infinite incorporation of new educational material by fitting the new knowledge sets in the existing knowledge tree.

Educational material in the form of images is incorporated in the system as compressed files created by a scanner (Hewlett Packard ScanJet IIc) using Aldus Photo-Styler®. Image files are stored in BMP format (Rosenfeld & Kak, 1982) in order to be device independent, that is their presentation will not be affected by the type of the monitor. These files and relevant text are linked to specific words in the text defined as hyper words. Activation of a hyper word leads to the presentation of the image and/or text linked to it.

The educational material in the form of text and/or images with their relational linkages serve as the domain of the system.

The Tutoring System

The tutoring system is addressed to students at the college level and contains a sophisticated graphical user interface which allows the student/user to access the educational material in four different interactive modes.

The first mode is the Course Mode, where the student/user requests from the program to present the material in the

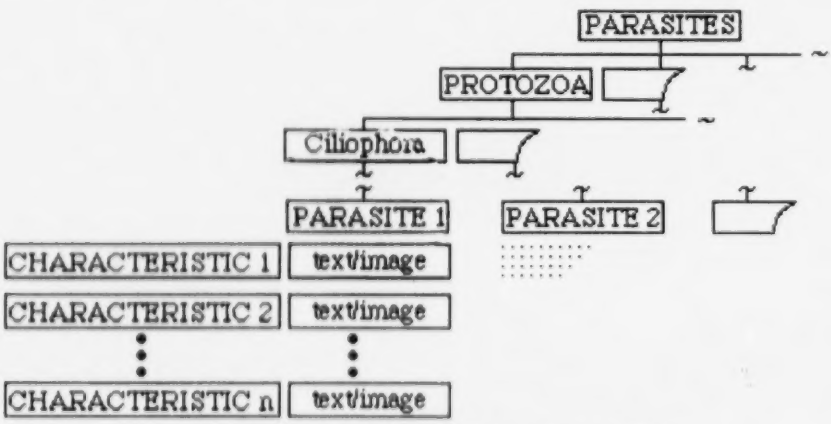

Figure 1. Inverse Knowledge Tree

hierarchical series of lectures given in the class during the semester.

The second mode is the Review Mode, where the student/user requests from the program to present a specific chapter from the whole material.

The third mode is the Reference Mode, where the student/user uses key words for Boolean searches in the entire material in order to locate specific information on a desired subject.

The fourth mode is the Self-Evaluation Mode, where the student/user requests from the program a quiz on one or more chapters in order to test his/her level of understanding of the material.

The above described tutoring system serves as the pedagogical expert.

Indexing of Key Words

Indexing of key words is accomplished by using a program developed for this purpose which first alphabetizes all the words of the entire text material and then filters out common words (Figure 2). This process leads to the creation of an indexed key word database. This database is then used for Boolean searches in the text material allowing the use of the system as a reference tool.

Quiz Generation

Quizzes are generated randomly by using a multiple-choice question and answer database. This feat is accomplished by using a program developed for this purpose which randomly selects a set of questions from the database every time the student-user wishes to evaluate him/her self. The student-user can select the quiz at the end of one or more chapters. For each quiz, a temporary database is created in order to keep the student's responses. Scoring of the quiz is executed automatically by the program at the end of each session. Also, the program can present the questions with the correct answers.

The quizzes along with the tutoring system supplement each other and implement the student model.

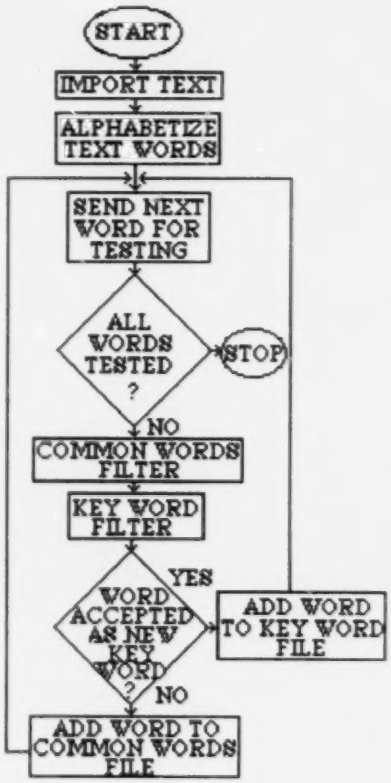

Figure 2. Key word/common word identification and indexing

Sample Run

The program starts by presenting the student-user with a window containing a series of action buttons activating the various interactive modes described above. For each mode selected, a series of follow-up windows are presented and lead the student-user through the educational material (Figure 3). At any point of the program, the student-user can switch to any other interactive mode.

Conclusions

The easy accessibility and the new developments in hardware and software

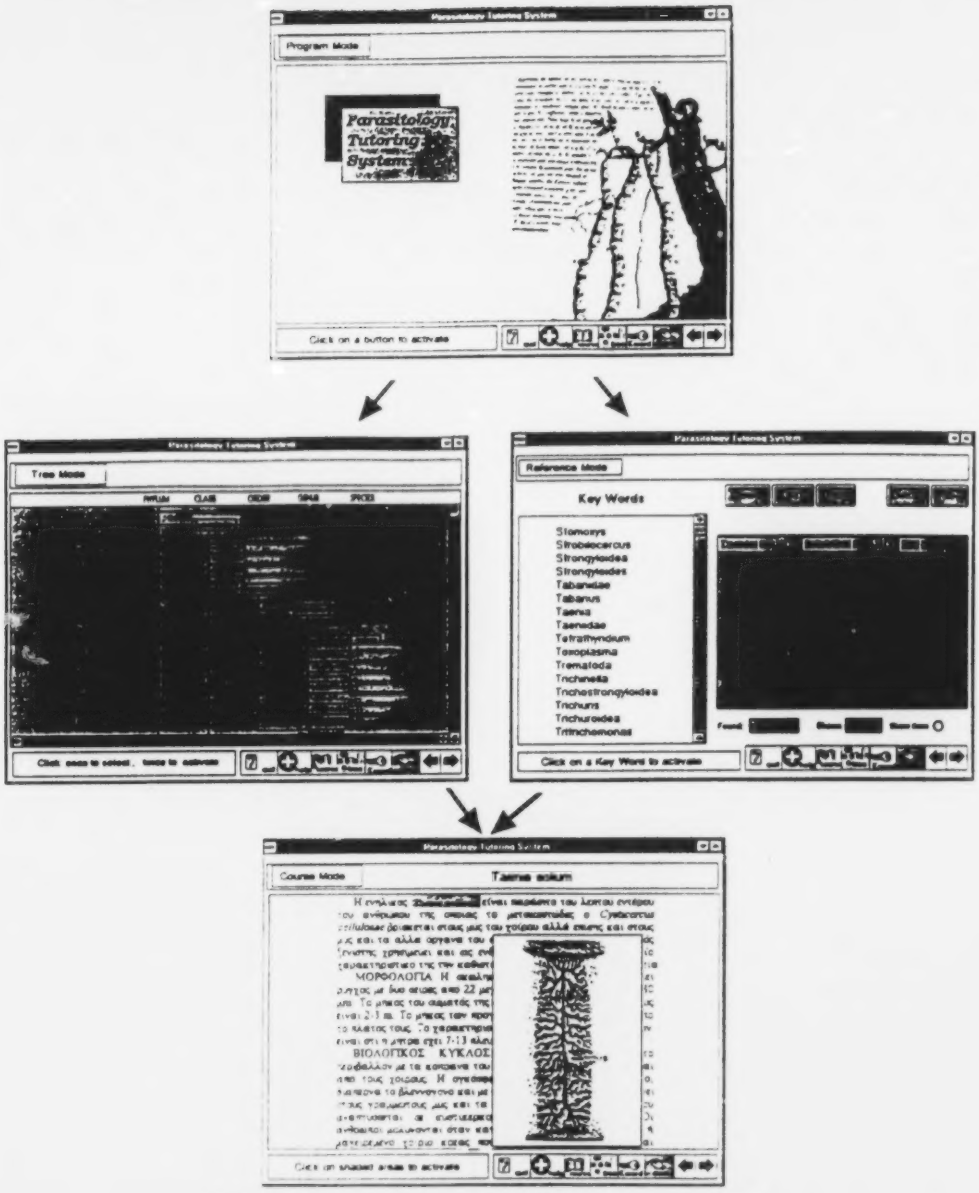

Figure 3. Series of follow-up windows

technologies make computers increasingly useful for various applications in the field of parasitology like image analysis (Kucera & Reznicky, 1991; Schall, 1989; Slomianny, 1990; Theodoropoulos & Theis, 1989, 1990), simulations (Barnes & Dodson, 1990; Mount, Haile, Davey, & Cooksey, 1991; Parry, Barratt, Jones, McKee, & Murray, 1992; Plaisier, van Oort, Remme, & Habbema, 1991), parasite identification (Theodoropoulos 1988, 1989; Theodoropoulos & Loumos, 1991, 1992), or tutoring (Wharton, 1990).

Generally, a tutoring system contains a domain expert, a student model, a pedagogical expert, and the user interface (Brown & Sleeman, 1982; Kearsley, 1987; Wegner, 1987). These concepts were used to develop an innovative

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computer-aided parasitology tutoring system.

The present program is based on hypermedia and object oriented technologies and serves as a parasitology tutoring system for college level students. The scope of this program covers all aspects of parasitology like hosts, life cycle, pathogenesis, etc. The educational material is presented through a sophisticated GUI in the form of text and/or images. The main advantage of this system is that it allows the student to interact with the computer-tutor in his/her own pace for self-learning and auto-evaluation.

The innovation of this system is its reliance on object oriented structures between knowledge sets allowing interactive learning for the student-users and unlimited capacity for new knowledge incorporation.

Another innovation of this system is its ability to present the material in various ways. The system can present series of lectures or specific topics for review. In addition, the system can be used as a reference tool by presenting key words or as a self-evaluation tool by generating quizzes with auto-scoring capacity.

A limitation of this program is its inability to support extended queries (SQL) due to its reliance on the built-in facility of Knowledge Pro®.

A future improvement of this program can be its integration with a multimedia relational database for parasite identification (Theodoropoulos & Loumos, 1992) to serve as a comprehensive expert parasitology system.

Hardware Requirements

The use of the program requires the availability of an IBM or compatible personal computer (80386, 2 Mbytes of RAM, VGA monitor and above) under MS-Windows 3-1®.

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THREE-DIMENSIONAL MEDIA TECHNOLOGIES: POTENTIALS FOR STUDY IN VISUAL LITERACY

by
Hal Thwaites

Abstract

The three dimensional representation of *reality* has suffered from chronic misconceptions over the years. Presently, there is a wealth of renewed research in 3D being undertaken on a global scale. This paper presents a brief overview of three-dimensional media technologies (3Dmt) such as holography, 3D film, 3D video/TV, virtual realities, and computer imaging. Future issues and concerns conclude the discussion.

Introduction

Our fascination with attempts to create the third dimension is nothing new, extending from the time of early stereoscopes, into the realm of virtual realities. The notion of 3D has always given reference to more *realness*, as human perception functions in a 3D mode. Today we seek to heighten our mediated experiences with continued efforts toward perfecting spatial imaging systems. 3D is the *buzz-word* of the 1990's even though not all of the '3D' is factually stereoscopic in nature. 3D computer graphics abound on television. 3D modeling is applied in many technical and scientific fields, 3D concepts are used in spatial environment design, while 3D medical imaging presents a *more real* look inside the body. The concept of 3D has even been extended to encompass the theory of human memory (Pribram, 1991). 3D as a mode of human thinking, is indeed becoming ubiquitous.

Current media

In this last decade of the twentieth century, new media are evolving from a joint metamorphosis resulting from the merging of computing, communications, and imaging technologies, exemplified by Figure 1.

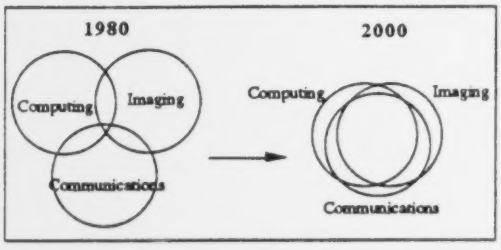

Figure 1. Convergence of Media

It is at the *intersections* that many new forms of media are developing. This merging is shaking things up (Leebaert, 1991). Many of the new 3D media technologies are the direct result of these new interactions. The computer is now an integral part of both the creation and display of stereoscopic images and spatial sound, which was unheard of on the present scale and sophistication, a decade earlier.

Impediments to which we have resigned ourselves are being smoothed, and altogether new products and media are becoming possible. The way to figure out what needs to be done is through exploring the human sensory and cognitive system and the ways that humans most naturally interact (Brand, 1987).

Three-dimensional media technologies (3Dmt) have always presented a challenge to researchers in their acceptance and widespread application as mass media. Throughout their evolution they have been applied in situations where we seek to create a more accurate representation of: *reality*, whereby 3D adds critical information to actual images; *meta-reality*, where 3D technologies make visible phenomena or experiences which are beyond what we

can naturally perceive; and more recently in *virtual reality*, involving the creation of totally artificial environments which might not physically exist or exist only in our imaginations.

Computer Imaging

Computer graphics (CG) are particularly well suited to the creation of 3D images due to the high resolution and programmable nature of the current displays. There are several proprietary 3D CG systems available in both the United States and Japan. Alternating frame technology is most often employed to present the viewer with the appropriate (right and left eye), stereoscopic images which are then viewed with LC (Liquid Crystal) shutter glasses, such as the systems made by Tektronix and the Stereographics Corporation (Robinson, 1990). A flat panel back-lit LC display, using a lenticular screen for autostereoscopic (glassless) viewing, has been developed by Dimension Technologies Inc. of New York. This system is full-colour, and can be interfaced with common PCs (Eichenlaub & Martens, 1990). Applications of 3D in the CG field include the following: satellite mapping and cartography, CAD, medical displays of CT and MRI images, scientific visualization, weather analysis, interactive modeling, simulation and the military (Lipton, 1988).

Computer graphics have also been used in film making, where the images are screened via conventional polarized projection techniques, after the initial creation of left-right views in a digital form. An example of the commercial application of 3D computer graphics is the award winning stereoscopic, animated short film entitled "Knickknack" (Alspektor, 1989), produced by Pixar of San Rafael, California.

Even more important for the advancement of 3D computer animation was the overwhelming success of the new 70mm. Imax format computer generated SOLIDO™ 3D film, "Echoes of the Sun," which was co-produced by the Imax Corporation of Canada and Fujitsu of Japan for the Osaka, EXPO'90 exhibition.

Thirty-one thousand high resolution computer images (right-eye and left-eye views) were created using Fujitsu's supercomputers over the period of twenty-one months, in order to produce the ten minutes of stereoscopic CG frames incorporated in the twenty minute Imax film. *Echoes* was the world's first IMAX SOLIDO™ full color 3D wrap-around motion picture which is projected on a spherical screen, totally eliminating the cut-off effect of the frame. The film shows how the process of photosynthesis converts the sun's energy into the energy stored in plants and then how this energy is used by humans for motion of muscles. This film also played to capacity audiences at EXPO'92 in Seville, Spain (Naimark, 1992), and is on permanent exhibit at the Futuroscope Complex in La Villette, France in addition to a new SOLIDO™ theatre recently built outside Tokyo, Japan.

Television and Video

Significant research has been undertaken in both conventional NTSC television and video display technology and in specialized applications (Smith, 1989). Japanese researchers are working towards 3D TV systems which may ultimately find way into our homes. Toshiba has marketed a consumer 3-D Camcorder, using LC shutter glasses and a conventional NTSC television monitor. The system provides an acceptable 3DTV image, (with some flicker due to the low frame rate), for certain consumer entertainment applications. Other NTSC video systems which operate at a higher frame rate, to eliminate the image flicker, have been applied in the medical and scientific fields.

Research into autostereoscopic or *glassless* 3DTV is being carried out on an international scale (Hamasaki, 1990) including work at the Institute of Industrial Science at the University of Tokyo, using

the Braun tube technology and at the Heinrich-Hertz Institute in Berlin using projection methods. NHK television in Japan has made important steps toward autostereoscopic TV with the exhibition of a 70-inch LC display at the recent NHK Science and Technical Research Labs 1993 Open House in Tokyo. The key technologies supporting this stereoscopic display are 3D HDTV cameras, HDTV laser videodisc players, high performance HDTV liquid crystal (LCD) video projectors with resolution totaling nine million pixels, and a large size lenticular screen, for glassless viewing. This 3D Hi-Vision display system has widespread application in the fields of home 3D HDTV, art museums, entertainment, medicine, education, robotics, and virtual environment systems.

The HDTV'90 Colloquium in Ottawa, Canada, was the site for the North American premiere of the NHK stereoscopic Hi-Vision 3DTV system. This system uses a conventional polarized projection technique. The viewer wears high quality polarizing glasses to view a projected image on a screen up to two hundred diagonal inches in size (Yuyama, 1991). The images are extremely stable, flicker-free, bright and of high resolution, providing an excellent viewing experience for the audience, with none of the side effects which were the typical complaints of older 3D video projection technologies. Current programs range from recorded art treasures, travel scenes, underwater sequences, medical images to complete works of fiction for entertainment.

The rock group, *The Rolling Stones* used the PullTime™ 3D technique (based on the Pulfrich effect, viewable with or without the special glasses), designed by Gerald Marks of New York City, to create 3D effects for three of the songs in their 1990 *Steel Wheels* concert video which was broadcast widely on cable music channels throughout North America. Altogether these developments represent a concerted effort to bring three dimensional television to the largest possible audience, since TV is the most pervasive mass medium of the late 20th century. For details and characteristics of the current 3D television systems, refer to Figure 2.

Holography

Spatial imaging using the medium of holography has had widespread recognition with the proliferation of holograms in our daily lives. However it still remains much of a mystery to the general public. As a result of the work carried out at the MIT Media Lab, under the direction of Dr. Stephen Benton, holograms have progressed to encompass full color, large scale size, and totally synthetic generation via the computer.

Recent advances have been made in real-time computer generated holography. Although the images are small, they are bright, have high resolution and exhibit all of the depth cues found in holography (Hilaire, Benton, et al., 1990). These are the first steps towards what could be called *holographic video*. We are still many years away from having floating 3D images beamed into our homes. Current applications of holographic imaging include large format displays, full colour holograms, motion stereograms, medical images from MRI data, satellite survey data, and many others, ranging from entertainment to advertising.

The human impact of holography lies in the fact that the image is *perceptually* attached to the viewer's eyes. It demands a high level of involvement and interaction since the virtual information space exists in the mind of the viewer (Malik & Thwaites, 1990). This medium has a radically different means of communication from 3D media presented on a flat surface. Here the existence of the screen or frame effect is removed and the absence of spatial cues (except those presented within the holographed object) cause the strongest information impact on the viewer. Holography is governed more by the laws of scenography (the spatial organization and orchestration of an event or medium), (Polieri, 1971), within the realization of the full 28 axis of a Necker Cube (see

Three Dimensional Television Systems

System	Key Principle -Tech.	Eyeglass Type	Viewable Without	Delivery System	Comments
Spatial Technology	Color-discriminatory anaglyphic	Red/green anaglyphic	No	TVbroadcast, videocassette	Color not always natural, images lose sharpness
Nuoptix	Color-discriminatory anaglyphic with Pulfrich Effect	Dark purple/ pale green lenses	Yes	TV broadcast, videocassette	Needs motion within image for 3D effect. Halo around images seen without glasses
PulfTime 3-D	Pulfrich Effect	Clear/Dark lenses	Yes	TV broadcast, videocassette	Needs motion within image for 3D effect
3-D TV (Toshiba, etc.)	Polarized plane discriminatory	Polarized & synchronized LCD	No	TV broadcast, videocassette, videodisc	Good colors, excellent spatial effects, marred by dimness & flicker
Vision II	Parallax & time discriminatory, autostereoscopic	None	Yes	TV broadcast, videocassette, videodisc, film	Very good texture, depth enhancement, full color
Braun Tube (Hamasaki Lab)	Autostereoscopic Lenticular sheet	None	Yes	Closed circuit, real-time	Bright images, presently only monochromatic
3D Projection (Heinrich-Hertz Inst.)	Autostereoscopic Lenticular screen, projection	None	Yes	Closed circuit, real-time	Bright, wide-angle motion parallax, monochromatic
3D Plasma (Flat Panel) (NHK)	Autostereoscopic Lenticular screen plasma display	None	Yes	Closed circuit	Glassless, flat pane monochromatic
70" 3D HDTV (NHK & Sanyo)	Autostereoscopic LCD projection lenticular screen	None	Yes	TV broadcast, videocassette, videodisc	No glasses, large screen, full color, hi-resolution
180" 3D Hi-Vision (NHK)	High Definition polarized, video Projection	2 channel, polarized plane discriminatory	No	TV broadcast, videocassette, videodisc	High-definition bright, wide-screen digital sound

Figure 2. Overview of 3D television systems

Figure 3). Since the viewer is not rigidly seated in a precise position, and is able to move through the holographic space, many of the spatial cues laboriously created on a 2D flat screen are not necessary, since the viewer now experiences them in a spatial, hodologic fashion.

Film/Cinema

Three dimensional film technology has been in use for over one hundred years, extending from the first screening at the Paris International Exhibition of 1890. After experiencing two brief periods of a 3D film boom, the first in 1953 and the second in 1982, we find that today's 3D movies are far from conventional media experiences. Widespread public exposure to high-quality 3D films can be found in the Disney theme parks with films such as "Magic Journeys" and "Captain EO," and at many other special venues and all recent international expositions.

Science North, outside of Sudbury Ontario, opened a 3-D 70mm film and

laser adventure entitled "Shooting Star" in the summer of 1990. This film incorporates special in-theatre laser effects which are synchronized with the 3-D film scenes to create a totally unique viewing experience. The theatre is specially constructed to maximize the audio-visual experience for the audience. The story is written around an ancient Indian legend which blends the high-tech 3-D imagery into a mystical and involving tale.

The Imax Corporation of Canada has been the world leader in ultra-large screen, 3D productions using IMAX 3D and the new SOLIDO 3D system, which uses the domed screen (Naimark, 1992). These films are evidence of the *meta-reality* aspect of 3D. Todays' 3D film experience takes us far beyond the reality of our physical world, to totally new experiences through the use of the third dimension. There are currently four new 3D IMAX films in production. It is certain that 3D film technology in its many forms will continue to be a prominent form of mass entertainment well into the next century.

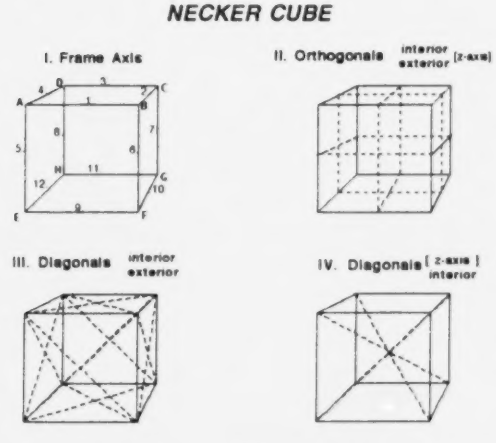

Figure 3. Necker Cube

Virtual Reality/Simulation

By the end of the 1980s *virtual reality* was understood to be a surrogate or metaphysical environment created by communications and computing systems (Wright, 1990). Interactivity in communication media began to rise in importance allowing virtual realities to become the 3D environment of the user/audience through which they can perform their own acts of creative experience.

Current systems being used for the creation of virtual realities consist of: a wide-angle stereoscopic display unit (LCD), glove-like devices for multiple degrees-of-freedom tactile input, speech recognition technology, gesture tracking devices, 3D auditory display and speech-synthesis technology, computer graphic and video image generation equipment. When combined with magnetic head and limb position tracking technology, the head-coupled display presents visual and auditory imagery that appears to completely surround the user in 3-space (Fisher, 1990).

Even at this early stage, virtual realities are touching the realm of the very private *mindspace* of the user, rendering the VR medium a welcome change from the information overload of today's mass communication media. Computer technologies, combined with the development of sophisticated software programs and expert systems, gave early attempts to create virtual realities the insatiable breadth and depth of the human mind's fantasy. Now it is possible to realize 3D virtual realities outside the human brain as a non-separable and inclusive world that is entered and crossed at the pace of the user, being co-created by them.

A Biocybernetic Viewpoint on 3D Media

Our research at the 3Dmt Center in Montreal has centered on a systemic approach to 3-D media, from a biocybernetic viewpoint. The field of biocybernetics is concerned with how the human sensory system responds to and processes information, and the resulting impact it has on us. Our main focus has been with the individual, either observing or creating the three dimensional media program. This is an area of an information

process or information chain. By the term information, I mean an energetic change with a catalytic characteristic, which produces an impact on the viewer (Thwaites & Malik, 1987). The information chain in its simplest scheme, has three parts as described in Figure 4.

Information Source →	Transmission Conditions →	Responding Receiver/s
3DTV, film hologram, VR	room, cinema theater, exhibit	individual, group, audiences

Figure 4.
Information Chain Scheme

Each part of the 3D media event (the program itself, the room and means by which it is perceived, and the person(s) perceiving it), can contain parts of the final information. If any part of the information chain is altered, the information itself is changed. The incoming information acts as a catalyst to other mental processes which occur due to the processing and storage of information in the viewer's brain and can thus affect the overall impact. As 3D media become more sophisticated and interactive, respect for the information chain and information design of the software/hardware interfaces will be of utmost importance to their success (Malik & Thwaites, 1990). The increased time and budgetary constraints that are often placed on 3D media projects leave little room for costly experiments and wasted resources. Protocols and methodologies for information design are included in the publication listed by the author (Thwaites & Malik, 1987).

3Dmt Outlook

From a research standpoint, the author can identify the following concerns for the future: a) The implementation of 3D technologies and production practices in the media of film, television, computers, virtual realities, sound, and dataspace (numerical imaging of space for researchers working predominantly with numbers); b) research into spatial impact: history, basics, biometry and biocybernetics, c) measurement of 3D space in the human mind; d) the application of information design methodologies to three dimensional media production practices; and e) the development of common standards and methodologies for future international exchange of R&D in three dimensional media technologies.

The implications for the study of visual literacy are to make the transition from conventional 2D visual images, into the realm of stereoscopic, true spatial imaging applications, whereby 3-space is real and not merely represented or implied through traditional techniques.

There is a substantial difference between technological, psychophysiological and semantic (content related) factors which are responsible for the creation of 3D media technologies, artpieces or programs, and the factors which are responsible for the creation of a 3D media response (information impact) in the viewer. What sometimes amounts to a small, or negligible cue from the point of view of the author (for example the cinematographer, holographer), may be the paramount reason which causes a high, low, or even non-existent 3D information impact for the people, the receivers, who are perceiving it. Therefore, the scale and importance of the 3D cues from the viewpoint of the artist, producer, or viewer, and the technological requirements of each 3D medium, may result in a different hierarchy entirely. This necessitates an information design approach when employing 3D technologies in the production of media artworks.

An entirely new generation of *visually literate* users/receivers is beginning to emerge. The more widely spread 3D media technologies become, the more exposure the general public will have to them (refer to Figure 5). Only through the exploration of the information impact of true spatial imaging, can we, as concerned visual media researchers, be able to develop strategies to educate future media professionals.

3D Media Applications					
TC	*Communication Broadcasting*	*Packaged Programs*	*Presentations & Exhibitions*	*Visual Databases*	*Digital Data Processing*
R	Mass & Specific Audiences	Mass Audience	Mass & Specific Audience/Users	Specific & Public Users	Specialized Users
IS	Home-Theater Sports Events Still Pictures Computer Graphics	Video Games Videodiscs Electronic Cinema Movies Multi-vision	Flight Simulation Virtual Realities Public Displays Education Environmental Images Advertising	Gallery & Museum Collections Catalogues International Treasures	CAD/CAM Architecture Auto Design Satellite data imaging Medical Imaging

Figure 5: Potential and current applications of 3D media technologies (IS=Information Source, TC=Transmission Conditions, R=Receiver)

Conclusion

As 3D media become more pervasive in society, and the fixed perceptual stereotypes of the general public weaken, the role of the 3D *information designer* will become one of increasing importance as we shift toward the media of the next decade. Perhaps in the distant future, someone will look back on the history of the twentieth century and find, like the fourteenth, that it marked a great transition. We now sit on the cusp between the old and new media. Maybe it ushers in a period of a *3D media renaissance*.

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FUTURE STRATEGIES AND INFRASTRUCTURES

THE ROLE OF INTERPRETATION IN COMMUNICATION THEORY

by
James A. Anderson

In American baseball, there are there positions on the crucial issue of umpiring balls and strikes:

"I call them as they are."
"I call them as I see them."
"They aren't anything until I call them."

Scholars working the fields of communication theory and research have variously ignored or problematized the relationship between sign and meaning. It is, of course, the fundamental relationship upon which all such theory and research findings must rest. As with most fundamental notions it remains characteristically unsettled (Sheriff, 1989). Philosophers of science are generally harsh in their appraisal of an early resolution. W. V. O. Quine (1953) argues that we can hardly know "what we are talking about" and Roth (1987) declares that there is no proof of meaning. Nonetheless both write, a performance which offers at least tacit agreement that something can both be said and read.

Sign and Meaning

This paper is an attempt to break into the relationship between sign and meaning, not with any intent at a resolution, but to catalogue the different positions taken and to investigate the work that gets done from these positions. It is Peirce's notion of the triadic nature of the sign which begins our difficulty. Peirce sees the semiotic nature of the sign being filled by its (a) material trace (the physical work, symbol, icon, etc.), (b) semiotic object, and (c) the relationship and its *recognition* between the trace and its object.

Questions are raised as to the manner in which material facts produce a signifying potential, the character of the semiotic object and the nature of the relationship that mediates sign and signifies as well as the possibility and its extent of our control over that relationship. These questions are raised at both points of focus within communication, the realm of symbol production or the move from the cognitive interior to the semiotic export and the realm of symbol interpretation or the move from the exterior sign to some conscious or performative understanding.

In the realm of production, the questions are generally these: What is the unformed resource, for example, of the words on this page? Who is the meaning maker? What is the site of the work of encoding? What are the resources of meaning making? How are those resources made available to the meaning maker? What is the necessity of intent? What is the formulation of an intent to mean? What is the recognition of the resources to accomplish that intent? How is its satisfaction accomplished (encoded in sign choice)? And where is its realization?

In the realm of interpretation, the questions might begin with: How is the sign recognized as a sign? What are the structural/genetic/learned/idiopathic components in that recognition and subsequent interpretation? Who is the meaning maker? What is the site of interpretation? What role does production intentionality play in sign recognition and sense making? What is the character and moment of semiosis? How are the resources of semiosis engaged? What is the nature of the product of semiosis? What is the conclusion of the interpretive event or task?

Communities of Answers

There are, of course, extensive literatures on nearly everyone of these questions, and we will do no more than touch the surface of each. One way to begin this analysis is to describe the central points along the range of positions from which answers have been developed. These centroids (if you will) can be plotted across the degree of determinacy in sign character, encoding, decoding, and interpretation. (Comparisons of this sort can be found in Outhwaite, 1987; Teichman, 1988; and Terwee, 1990, among many others.)

On the Far Right: Naive Empiricism and Brute Sense Data

We might begin at the most determinant position, one that has been dubbed the "brute sense data" or physicalist position. This position echoes the naive empiricism of Bacon, Locke, and Hume in that phenomenal world is a set of natural signs which represents a set of true conditions (Teichman [1988] provides a fair review of this argument). In this position, the character of the sign is wholly reputable and is responsible for encoding, decoding, and interpretation. Language and other constructed signs can be literally true. Something can be meant and encoded without error given an act of nature or the proper level of competence. Semiosis is the "natural" decoding operation of the sentient instrument which is a trustworthy observer of the sign and its encoded meaning. Interpretation is an elaborated understanding of the sign in its setting and the purposes we have for it. It is directed by right reasoning.

We can recognize this physicalist position from the close of the sixteenth century, and clearly see it as a fundamental argument of empirical science yet today. It has resisted efforts to tear it down but its erosion has been in earnest since the partitioning of the mind by Freud and Jung and the partitioning of reality by American pragmatists and continental scholars. Nonetheless, behaviorism was and remains the obvious restatement of the primacy of the stimulus. Many studies in communication, particularly effects and literacy studies, reflect the behaviorist tradition and are conducted "as if the brute sense data position were true" while the authors would probably demur that "of course it's not."

The "as if" portion of that claim is upheld by any study which (a) holds that content has a definitive meaning, (b) treats content as the delivery system of that meaning, (c) declares content to be the agent of some consequence in an audience, and (d) treats the audience as a reactant. Such studies have adopted an "as if" stance on the physicalist's site. The researcher first asserts both an ontological and praxeological claim by declaring content to be something--violent, pornographic, scary, informative, persuasive--to someone else. The subsequent behavior of the someone else is attributed to the content exposure. Examples of these "as if" studies would include the classic Berkowitz (e.g., 1963) and Bandura and respective colleagues (1961, 1963) studies as well very recent ones by Phillips (1983), Rosenthal (1986), Wilson (1991), and Zillmann and Bryant (1982).

Breaking the Connection: The Introduction of Perception

By the close of the nineteenth century, the general belief in the unmediated character of sense data gave way to the recognition that human understanding required a perceptual process to intervene between sensation and cognition. Continuous sensory data had to be perceptually organized for us to experience the world's phenomena. Encoding was no longer wholly dependent on the character of the sign and there was slippage between encoding and decoding, so that the sign and its interpretation were no longer one. Perceptions were (and generally are) nonetheless considered to be authoritative representations of actual phenomena although error and bias can occur.

There arose a large class of studies which examine the perceptual process--the whole Gestalt school, for example. These studies hold perception to be an orderly, reliable process with predictable failures (any of the bent line perceptual tricks) and problem areas. (As an aside it should be noted that any declared failure has to be judged against a more privileged perception. A line, therefore, is straight to the ruler but bent to the eye and the choice of which one is true is conventionally made.)

Perception has also been used to indicate a subjective response. Studies of this sort have titles like "Perceived fright values of horror films by 8 year olds" or "Perceived attributions of gender differentiated characters by adult males" (for an actual example see David [1992]). The implied argument is that there are either real fright values/attributions (e.g., the classic "knife in the hand" study) or that there is no objective basis for claiming particular fright values or attributions, and consequently the ones expressed by the respondent groups is a characteristic of their taxonomy (for an example, see Frost & Stauffer, 1987).

The subjective is further developed in studies which use "relevance triggers." These studies (e.g., Inyengar, 1979) attribute differences in outcomes to devices which serve to position the respondent (usually by reminding them of some doctrinal stance).

Both are arguments that one's vision of reality is marked by social conditioning[1], but at the same time, because the researcher can determining the real or the objective such markings can be resisted by the well trained. That this good training can be extended to others is one of the principal tenets of media education (Anderson, 1980). It is seen in training efforts to produce the skills that result in the right perception of deceptive or otherwise inappropriate media fare.

Perceptual processes are also the underlying support for interventions in which one message (and resultant understandings) is to form the basis of the perception of some subsequent presentation (see Donohue, Henke, & Meyer, 1983). Such studies are extensions of the forewarned is forearmed principle. For example, children who had the opportunity to handle real earthworms prior to their exposure to a film clip which depicted a giant earthworm monster had reduced fear responses (Weiss, et al., in press). The prior exposure was seen as directing the effect of the film.

The precept that perception is a requirement of human understanding has general acceptance among the scientific community. Its application, however, varies widely.

In the majority of effects studies, its operation is either ignored or considered to be a constant across all respondents. This transparent perceptual process is effectively a return to brute sense data. When perception appears in effects studies, it is often used as a marker of respondent typification by class, gender, race, education, and the like (e.g., Zemach & Cohen, 1986). These typifications are accomplished by differentiated responses to material which in itself is considered perceptually neutral across these categories of influence. The operation of perception, then, is considered a constant across type.

In some studies, the issue of perceptual error or bias is inserted (e.g., Vidmar & Rokeach, 1974). Perceptual bias must necessarily imply some alternative non-biased position from which it can be viewed. Usually this position is that of common sense (held by the researcher).

Relevance triggers and intervention studies offer a more complex application arguing that perception can be shaped at the moment of reception of the focal message. The step beyond these studies is the argument that perception must be shaped (and is, therefore, in each and every case somehow shaped) at *any* moment of perception. Nonetheless, the

potential of that step shows perception to be the social science equivalent to the deconstructionist subjectivity--the relevance trigger as interpellation.

Perception puts the character of the message at the point of reception in play. Beyond the rules of competent production, the perceptionist has little to say about the message as encoded. In most perceptual analyses, that encoding is fully justified by authorial intent (it is a different community which introduces polysemy).

The legacy of naive empiricism is clearly seen in the loose and friendly way in which perception offers its presence to research. It imposes no requirement too account for its operation, but one can use it if desired. Researchers are free both to hold to perceptual processes and to presume that they have no effect, that treatment messages can change perceptions but research protocols will not, that others are subjective but researchers are not, that the untrained are biased and the trained are true. A more difficult presence would require, at the least, researchers to abandon any claim of what a message is prior to its interpretation by a target audience and would compel the analysis of that interpretation in any study of effect.

Perception remains, at this writing, a theoretical device to solve anomalies which have arisen in testing the central empirical claim of a generally unmediated engagement of phenomena, material, and semiotic. There is little evidence as to material operation. As Bolles (1990, p. xi) notes, "Not only do we not know how perception works but we haven't a clue as to how it might work." Its character in theory and method is firmly in our own hands.

Creating the Semiotic Object

In most perception studies, we are looking at the perception *of* something. Theres is a material, factual object with a reality independent of the perception per se. This is the independent character of the signified. For example, Pettersson (1988) speaks of a "figure" which becomes the number 13 when placed in a sequence of numbers and the letter B when placed in a sequence of letters. It, however, pre-exists as a figure before it is perceived as a letter or a number.

The theoretical break between material and semiotic objects comes with the claim that the figure's existence as a figure is also a perception. Indeed, all objects are the product of the sign. The material facts of their existence are the bounded persistences of reflection, refraction, absorption, and the like. Those boundaried persistences become what can be known when they are coalesced into a semiotic object. (A relationship of persistences becomes a chair only in the presence of a mind, although the relationship continues even in the mind's absence.)

This move changes the phenomenal world from a world of material objects to a polysemic world of material semiotic potentials. In this latter world, there are material foundations for what is seen, but what is seen is always the product of the mind (Gibson [1966] and Sacks [1993] call this the creation of a perceptual self).

While images of Berkeleyism and trees falling in the forest may dance in our heads, there are positions in this phenomenological constructionism which work in the same way as the physicalist's brute sense data. One need only to posit universal rules governing the relationship between material potentials and resultant semiotic objects to return us to the beginning. We start to move toward the wonderland of Lewis Carroll when we release the semiotic object from the universal sentience (or at least universal human sentience) of Peirce and Husserl and (a) cultural processes enter in the equation, so that the same material foundations are used to produce culturally different semiotic objects (culturally different boundaries of color is the usual example); (b) the semiotic object is greater than the material foundation can warrant (pictures might be an example); (c) the

material foundation is itself a set of human practices which must be understood semiotically (the idea of justice).

We move closer to the Red Queen when by defining the semiotic object as the set of socially determined understandings in play for some material foundation (what Crapanzano, 1992 calls "centering") in some cultural era or, more radically in some community of understanding. By putting what is signified in play, we affirm the social construction of reality and open the door to different ways of thinking across generations and communities. The result is that collectives of the same ostensible language group use the same material resources of semiosis to achieve in their well-practiced and naturalized methods different worlds of everyday life (Morely's [1980, 1986] work in caste based understandings of soap operas a good example). The sign remains reliable (within limits of perception) within a community but not across communities. The question remains as to the size, scope, quality, and character of reality defining collectives. Were one finds an answer in this liberation of the jointly-held mind to create the reality of its understanding is the defining point of theoretic and methodological ontology.

Whatever one's ontological position, the constructionists ferrying of objectivity from the phenomenal world into the realm of collectively governed cognition changes a number of fundamental tenets (a good development of these is in Seung [1982]): Reality is no longer universal and is determinate only within community boundaries (even if the boundaries encompass us all). The individual is no longer the measure; the collective stands in that place. We no longer perceive a preexisting object but create a perception out of possibilities. The adjudication of error is no longer from a standard independent of the researcher. In sum, the trustworthiness of the sign as well as its ability to drive an interpretation are reduced to collective boundaries, and encoding and decoding are volatile practices as they migrate across those boundaries.

The Final Deconstruction: Attacking the Character of the Sign

Remembering that the Peircean sign is composed of a material trace (natural or composed), the object for which it stands and the acknowledged relationship between the two (Noth, 1992), our work to this point has been to consider the manner in which the material trace is recognized in perceptual processes and the methods of social construction by which the semiotic object is formed. Throughout those two analyses, once the material trace is grasped in perception, its object (however achieved) is presented in a reliable relationship. I have called this trustworthiness of the sign. I believe it reasonably represents, along with perception and social construction, a significant boundary among different theoretical communities. We are about to cross that boundary.

Our philosophic guides are the likes of Schleiermacher, Dilthey, Kierkegaard, Husserl, Heidigger, Gadamer, and of course Derrida, but we also gain direction from American pragmatists, social interactionists, and interpretive sociologists. In crossing the boundary we abandon any transcendent relationship between sign and meaning. Instead we focus our efforts on understanding how a sign is always in the process of becoming meaningful, always in the process of creating the relationship between what can be recognized as the possibility of understanding and what can be understood.

From Derrida, ("Speech and Phenomena," 1972) to Barthes ("Pleasure of the Text," 1975) Eco ("Semiotics and the Philosophy of Language," 1984) to Caputo ("Radical Hermeneutics," 1987) the hermeneutic position--this position of the other side--argues that signs are the contingent means of managing the flux of the present. Signs rather than being referential are encyclopedic. They reach out in every direction in an infinite

potential which can be but partially realized in any instance. Signs are the command to make meaning in a collectively recognizable, local performance of sense making.

What something means, therefore, is answerable only in the present, only at the site of considerable efforts which provide for its construction and must be answered anew at the next asking. That answer will have to take into account the tension between collective efforts to sustain meaning (through persistent and overlapping performances) and the necessity of its local and partial expression by some agent[2] of that collective. These requirements in no way deny that retinas respond to light energy in predictable ways, that brains reliably recognize the stimuli of their perceptions, and that minds are shaped by culture and the practices of socialization. They simply claim that retinas, brains, and minds are not enough to understand meaning. One must also understand action for it is in action that meaning may become.

Now before we all drift out of sight, the methodological consequences for this theoretical stance are (a) to establish the framework of on-going effort which permits meaning construction as the target for our methods; (b) to nominate methods which reveal on-site the material practices of that effort; and (c) to recognize that the facts revealed are themselves the product of some other framework. Using collective resources, the agent meaning maker achieves some local understanding. That local understanding can be repeated elsewhere and by others but that repetition is its own work.

Hermeneuticists have divided along two lines: One, following the phenomenological trail, has held to the primacy of language in constituting consciousness. The other, more existentialist, has held to action as the means by which the self appears. This theoretical division has shown itself in the practice of scholarship by the appearance of textual based critical analysis (Carey, 1989; Huck, 1993; Grossberg, 1984) and performance based interpretive ethnography (Anderson & Goodall, in press; Anderson & Meyer, 1988; Goodall, 1991; Rose, 1990).

When scholars abandon the trustworthiness of the sign, they are faced with the continuous study of the methods of the production of collective resources, of one's access to them, of the subjectivity of agency, of the authority of action, and of the voice of its extension. All the while they are called to realize that they are the authors of this knowledge and subject to the same analysis. As in "Fatal Attraction" nothing is finally submerged, but, knife in hand, rises again and again.

An aside: To put a fine point to it: For the latter day hermeneut, were Herb Zettl to make a claim about the meaning of visual vectors, he would be making a claim of what *ought to be* rather than what it is. His writing and scholarly life *would go about the work of making it so* (even to speak from the mountains of Delphi). Claims of meaning are the unending work of claims to authority.

An Overview of Positions

We have looked at four more or less separate positions from which to compose answers which might address the questions posed at the start of this discussion. They are the physicalist, perceptionist, constructionist, and hermeneuticist arguments. The physicalist view is one of an organic machine reliably responding to independent empirical phenomena which drive isomorphic representations of consciousness. Language is a genetically based system of representation of phenomena and pre-existing categories and the extensions of both.

The perceptionist can occupy a broad region, at one end very close to the physicalist, noting only certain discrepancies in the reception and interpretation of sensory information, at the other, speculating on perceptual

realities only loosely connected to sensation. Language remains a genetically based system of representation of phenomena and preexisting categories but can be enlivened (or corrupted) as well by perceptual variation.

The constructionist draws the conclusion which the perceptionist resists: If perception intervenes between understanding and the phenomenal world, then we must be active participants in co-constructing the world we believe in. Language has physical foundations and formal structures, but its system of representation is a practical human achievement--a given in which we all enter and contribute.

The hermeneuticist takes the step beyond metaphysics and puts it all in play as the struggle for meaning is the work of everyday life. The placement of meaning is the successful expression of power. Language is physical, structural, and representational but its meaningfulness is not in genetics, structures, or representations (any combination of signs can be made meaningful) but in its material presence in action.

A Collection of Answers

Tables 1 and 2 present our initial questions concerning the relationship between sign and meaning in reals of sign production and interpretation respectively. The Tables provide short references to the questions and rather cryptic answers which allow us to see the points of difference but do grave injustice to even a marginal articulation of these complex issues. This injustice is somewhat rectified in the sections that follow which enlarge the answers provided.

The Realm of Symbolic Production

Unformed Resources

The major contrast is between the physicalist/perceptionist pair and the constructionist/hermeneutist pair over what's prior to the semiotic. For both the physicalist and the perceptionist, the semiotically unformed resource of understanding is a verifying phenomenal world which can be engaged in an objective fashion. Signs have meanings independent of their creation. The shadings between the two deal with the degree of mediation involved in the engagement of this objective reality.

For both the constructionist and hermeneutist there is nothing prior to semiotics in understanding (see Wertsch's 1985 overview of Vygotsky and Bakhtin). What we know of the phenomenal world, we know semiotically. Meaning is a cultural production. The differences between this pair have to do with the security of meanings. For the hermeneut meaning is never secure but always open

Questions:	Physicalist	Perceptionist	Constructionist	Hermeneutist
Prior Resource	Empirical Reality	Perceived Reality	Semiotic Achievements	Collective Achievements
Meaning Maker	Automonous Rationality	Perceiving Subject	Situated Subject	Acting Subject
Encoding Site	Individual	Individual	Ideological Collective	Agent in Collective
Intent	Required	Required	Utilized Not Required	Part of the Action
Resources	Genetic	Genetic and Cultural	Human Accomplishments	As Available in Action
Intent Accomplished	Proper Encoding	Perceptually Encoded	Rhetorically Encoded	Coherent Action
Intent Realized	Proper Decoding	Perceptually Decoded	Rhetorically Decoded	Local Utility

Table 1. In the Realm of Production

to innovation, opposition, and resistance.

Meaning Maker

Answers to this question show a steady decomposition of the monadic self. From the universal representor to the nominated, contingently acting subject, the meaning maker becomes more and more collectivized and requires more and more description to understand that instrument of sense-making. For example, while it is true that a person wrote these words, the question remains as to whether he was acting autonomously or as a cultural agent or as a tool of collection action.

Encoding Site

Again our pairs split, this time over the primacy of the individual and the collective. The right hand holds encoding to be the creative act of the intending individual. The left holds that the encoder is a clerk of the collective whose invention is wholly derivative.

The Questions of Intent

The role of intent for the physicalist and perceptionist in symbolic production is to establish the motive for production and the "right meaning" for the text as well as the basis for judgment concerning the proper encoding and decoding. This position requires a belief that intent is prior to the text and extractable from the text (for an extended discussion of the necessity of intent, see Avramides, [1989]).

Intent need serve no validating purpose in domains of the constructionist and hermeneutist. For the encoder, intent may well arise after the symbolic product has been formed and may subsequently be revealed in the on-going action. For the decoder, intent is a device used to advance a particular claim of meaning or to execute some interpretive performance. In both cases, intent is an invention not a determinant.

The Realm of Interpretation

Sign Recognition

In the first two categories sign recognition is a function of the incoming information. The concept of an adequate stimulus is one which excites the sensory nerve. It is that excitation which is recognized and its object source reproduced or perceived.

Table 2. In the Realm of Interpretation

Questions:	Physicalist	Perceptionist	Constructionist	Hermeneutist
Sign Recognition	Adequate Stimulus	Adequate Stimulus	Difference Boundaries	Difference Boundaries
Sign Interpretation	Hard Wired	Hard and Soft-ware combos	Practical Accomplishments	Actional Accomplishments
Meaning Maker	Sensory System	Perceiving Subject	Situated Subject	Acting Subject
Site of Interpretation	Individual	Socialized Individual	Ideological Collective	Social Action
Semiosis	Sensory Engagement	Perceived Stimulus	Ideological Engagement	Action Engagement
Semiosis Engaged	Liminal Stimulus	Cognition Initiated	Collectively Managed	As Initiated in Action
Authorial Intent	Directs Interpretation	Directs Interpretation	Point of Comparison	As Required by Action
Semiotic Product	Isomorphic Representation	Perceived Representation	Positioned Representation	Contigent Interpretation
Interpretation Conclusion	Moment of Sensation	Cognitive Recognition	Enactment of Subjectivity	Enactment of Acting Subject

In the latter two categories the incoming information has to be punctuated to be recognized. Objectification is first step of interpretation, provided for and driven by collective resources.

Sign Interpretation

Sign interpretation shows a decomposition similar to that of the meaning maker. We move from the universal electro-chemical operations of neurons (which is the singular definition of literal meaning) to an increasing differentiation and collective implication of the interpretive performance as a local and partial product of the acting agent.

Meaning Maker

As in the production realm, the physicalist is clearly separate from the rest on this question as that position works for system rather than subject answers. The remaining positions will necessarily construct a responding subject, self-contained for the perceptionist, collectively invoked for the constructionist, and implicated in social action for the hermeneutist.

Site of Interpretation

An inside/outside split characterizes the difference between the right and left pairs. For the first, interpretation "happens" in the individual in sensory or cognitive processes. For the second pair, interpretation is collective achievement prior to the individual whose role is evocation or enactment.

Semiosis

Semiosis--that moment of semiotic understanding--occurs for the physicalist at the moment of neural response, for the perceptionist at the formation of a perception, for the constructionist at the moment the sign is ideologically positioned, and for the hermeneutist at the moment of becoming in action. Our first pair offers a "behind the eyes" definition which is strongly dependent on the individual as the acting unit. Our second sees semiosis as a collective process in which the individual participates but cannot achieve on its own.

Semiosis Engaged

The physicalist defines semiosis engagement as the moment a gate passing stimulus is presented. That is insufficient for the perceptionist, as cognitive structures (variously called values, attitudes, schemata) must be brought into play. Therefore it is the implication of these structures which signals the engagement (and for some the terms) of semiosis. Both of those definitions are far to interior for many constructionists and certainly hermeneutists who want to emphasis the "out front," material practices of the collective requirements and directives of what we can come to understand.

Authorial Intent

True decoding in the physicalist and perceptionist camp must follow the requirements of authorial intent be it natural or human. Decodings accounting for intent in the remaining two are simple variants of the possible with no particular veridical standing.

Semiotic Product

We divide our pairs on the issue of representation versus interpretation. (An interesting discussion of representation meaning can be found in Gillet, 1992.) Neither constructionists nor hermenuetists may innocently claim representation. There is, for neither, nothing independent of the semiotic to represent. A sign is the interpretation of another sign. Any representation, then, is a practical accomplishment of semiotic maneuvering.

Physicalists gave up the little of representation they were going to with Kant's priors and perceptionists generally hold that there is always an independent

factual (albeit sometimes trivial) expression available to reconcile perceptual differences.

The Conclusion of Interpretation

Interpretation concludes at a definable moment for the first pair. This moment is defined as that of sensation and of cognition respectively. The definitive character of the moment is a significant division for at its conclùsion the interpretation passes from consequent to antecedent. As an antecedent it is the motive for subsequent behavior. It is this theoretical moment upon which the whole effect literature hangs.

There is no such moment for most of the remaining theorists. Interpretation is an emerging process not an instant. Its activity certainly subsides but need never end. Interpretations are not the independent cause of some subsequent action rather they are accommodated within the larger performances of ideology or everyday life. (Under this rubric, one does not stop at a traffic light because it is red, but because one is driving).

A Subsidence

An exploration of theorizing communities runs a number of risks not the least of which is the fundamental lie that there are necessarily centers to be explored. I recognize my own essentializing moves here, nonetheless, interpretation stands as a significant issue across which substantial divisions can be traced. We as a community of scholars (and as an Association) do stand divided in practical ways which affect our ability to normalize our scholarship. Perhaps that is a happy conclusion.

Footnotes

[1]And sometimes more darkly by racial characteristics. See Anderson, (1992).

[2]The word agent is used in both senses of the term: Agent as a participating cause in its own right and agent as a representative, here of collective interests.

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THE ROLE OF EDUCATIONAL TECHNOLOGY

by
Penelope Calliabetsou

This paper deals with certain fundamental questions which I will try to answer briefly.

In a United Europe, the teaching of multiform foreign languages in a multicultural United Europe can not distinguish between instruction of culture and instruction of speech, which is the most authentic form of its expression as well as the best vehicle of study research, contact, and proximity.

According to anthropologists, culture includes the total expression of a people's ways of living, its social hermitage transmitted to individuals through the process of socialization, and kinds of behavior, habits, and characteristics which compose the uniqueness of specific people.

In this paper, the terms *interculture* and *intercultural* are used to refer to the group of European culture instead of a particular national culture.

By the term *intercultural approach* in foreign language instruction I simply mean the comparative study of cultural elements between native language and one or more foreign languages.

1. What objects of study (groups, issues, etc.) should be included in foreign language intercultural instruction which modern Educational Technology is called to support?

The variety of available programs can become a trap for researchers throughout Europe: I believe that we should set a list of priorities on issues which may become educational objectives in European countries. Issues related to socialization, which are suitable for comparative studies, should be given a higher priority. As an example, consider: ways of living, habits, everyday life, tradition, etc.

2. Which research reports or educational productions are suitable for comparative studies in the classroom and could be implemented through a collaboration of various agencies from different European countries?

Consider, for instance, foreign languages departments of universities, pedagogical institutes, technological institutes, educational radio-television, and others.

As further examples, I mention:

- Electronic banks of intercultural elements that serve the needs of foreign languages instructors.
- Production of intercultural *dossiers* with printed and audiovisual material focussed on issues such as: the working mother in Greece, France, England, etc.
- Movie adaptations of literary texts.
- Audio-visual expositions designed to encourage contact with different countries.

3. Which production of comparative studies could be realized through collective processes among different classes of foreign languages students in different European countries?

- Studies and research conducted by groups of students from three or more countries of basic stereotypes which often disorientate students from

cultural reality. Videotapes are quite suitable for production and educational processing of such data.

- Round-table television and radio programs which include foreign students and focus on a variety of issues, such as: How do you feel about foreign words borrowed by your native language? Are they elements of threat or enrichment?

- Various publications and journals which could be issued by *fraternity classes* in different European countries.

- And, finally, newspapers issued by students with a European outlook under such titles as *Europe is Yours*, *Good Morning Youth of Europe*, etc.

4. What kind of new educational support material would be required to implement interculture in conjunction with traditional books: Books on civilization, various elements incorporated in text books, etc. We could indicate, for instance, the following:

- Linguistic and social behavior grammar accompanied by videotapes and audiotapes. For example: What wishes are exchanged in Greece, England, and Italy on the occasion of a birthday celebration.

- Video dictionaries on cultural concepts of basic, everyday vocabularies of foreign languages.

- European intercultural video collections: *Present Yourself, in all European Languages*, *Say it, in all Mediterranean Languages*, *Greet, in all European Languages*, etc.

5. Which networks of modern technology best transmit and instruct European interculture?

Computers

As it is known, there exist data bases allowing students to become acquainted with other countries and peoples. These data bases are usually accompanied by material bases that can be used in educational activities promoting judgmental analysis and data processing.

Such activities include games, questionnaires, etc. Let me mention, here, some productions: *Countries of the World*, *European History Series*, *Revolutions*, *Correct Behavior*, *The French Way*.

Peripheral Audiovisual Means

They include a relatively new type of educational technology that offers new prospects to language and culture instruction. I am referring to Video Interactive. This is an electronic system combining videodisc, computer, and a new type of memory.

Video interactive application in schools of different European countries has greatly contributed to the students familiarization with foreign cultures. In many countries, students themselves have started producing videodiscs to assist in foreign language and culture instruction. An example of this is Videodisque Siville, a production by British students who are learning French through a lecture on *French Commerce*.

An Electronic mail or telematics, is another peripheral audiovisual network that secures authentic intercultural communication between classes of different countries.

Electronic mail has existed for several years in many countries. For example, British and German networks are connected to *DIALCOM*, an international electronic mail network. In addition, the

French network *MINITEL* has extended its communication network into schools in Great Britain and France. As it is known, the authenticity of the message always stimulates students' interest, enhances imagination, activates productivity, and promotes dreams for the exploration of new situations.

The European Council promotes the introduction of Educational Technology in the teaching of foreign languages and culture. It further encourages and supports co-production of multimedia programs to assist instruction of European languages. Such programs are positive steps towards the direction of mutual understanding and respect of the European and national cultural mosaics.

The Important Role of Mass Media

The continuous technological changes in mass media have brought continuous renewal in the pedagogical and methodological approaches to language and culture instruction. Knowledge storage devices, like tape recorders and especially magnetoscopes, allow for a real revolution in the area of language and culture instruction. Magnetoscopes allow image freezing, selective storage of educational material (instead of just the projection of images), and is further capable of replacing us when and where we want it (at home, school, etc.), through simple programming.

The *robotization*--if you allow me to use this expression--enables instructors and students to use television material according to their educational objectives and needs. They can choose between live transmission and transmission of stored materials. An instructor alone or with his students can now choose multiform authentic educational material by using not only the traditional foreign languages book but television as well. In this context, television plays a double role: It is a transmitter and a producer of educational material.

At this point I would like to add that this *passepartout* educational material overcomes the differences between a student in Athens and one on a small forgotten island, and promotes free access (democratization) of knowledge.

In several European countries, mass media follow a production track which will quickly lead to the establishment of a second, parallel school of foreign languages and cultures. At this point I will refer to certain specific television stations which have already taken such initiatives: The first international French television station, *TV5 Europe*, broadcasts programs in 23 countries. A large number of these programs, which are being used to instruct french language and culture in various countries, are particularly addressed to youth.

The French television station FR3 broadcasts *Eurojournal* every morning (8:00 am to 9:00 am) and consists of 15 minute programs in English, German, Spanish, and Italian. Subtitles are used, and students can review the text of the program in their *MINITEL* screen via network *EURIDICO*. Teachers use such broadcasts to teach foreign languages or comparative cultural studies, depending on the program content.

Television station *SEPT* broadcasts multilingual European programs which are European co-productions. Finally, there are a British and a German television station offering such services.

Based on these still growing initiatives we could expect seeing in the near future a multilingual and intercultural trend which might create a new relationship among school and television. Why not? There is one issue I am personally in favor of: Mass Media and travel throughout Europe without boundaries will create new opportunities in foreign language learning.

Educational Satellite Olympus

Olympus is the first European educational satellite of long-distance

multilingual education. It started operating experimentally in 1989.

All countries participating in this project broadcast their educational and cultural programs. Therefore, the risk of monolingual and cultural monologue in Europe can be avoided.

Within the framework of the European educational policy, the idea and application of long-distance educational programs will be a must from now on for every developed country.

In audio-visual European landscape, where national television stations in certain countries broadcast quite a few educational programs, it is reasonable to conclude that the future of Educational Television belongs to educational satellite television.

Educational Radio-Television

Educational radio-television stations in several European countries broadcast foreign language lessons either locally or nationally.

The variety of types of technology as I have tried to briefly describe above, through speech and image authenticity can promote national and European objectives of intercultural communication within the classroom and various European classes.

The road to European interculture is exciting but long, and difficult. It is this road our youth will walk through. Our great responsibility and duty is to create the appropriate conditions which will allow them to live together in a peaceful Europe and in an environment of continuous intercultural dialogue.

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USING VISUAL MEDIA TECHNOLOGIES TO INVESTIGATE COGNITIVE REPRESENTATION OF TECHNICAL DIAGRAMS

by
Richard Lowe

This paper describes a selection of ways that visual media technologies have been used to support various aspects of research into the way technical diagrams are represented in people's minds. Its purpose is to demonstrate how such technologies can address some of the difficulties inherent in conducting research in this area. The research programme for which the techniques described here were devised has the broad goal of understanding how learners deal with instructional diagrams.

While illustrations in general can be included in instructional materials for a range of different purposes (Levie & Lentz, 1982), a central role of diagrams of the type used in technical domains is to explain some aspect of the subject matter (Levin, Anglin & Carney, 1987; Lowe, 1993). To date, much investigation of expository illustrations such as diagrams has focussed upon their instructional outcomes, rather than upon the processes by which these outcomes are generated. However, the rise of information processing approaches to the study of thinking and learning in recent years has highlighted the need to understand mental processes in trying to improve instructional outcomes. With this has come an increasing interest in the mental processes involved in the comprehension of pictorial materials such as diagrams (e.g. Winn, 1991). Fundamental to these mental processes is the way in which the information upon which they operate is represented in our minds. Consequently, before we can fully understand how diagrams are processed, we need to know about the mental representation that people develop for the graphic elements which are the fabric of those diagrams. Unfortunately, a person's mental representation of a diagram is not directly accessible to us for the purposes of study (unlike the outcomes of a diagram-based instructional task) and so its characterization presents a considerable research challenge. As a result, the methodologies involved in such diagram research of necessity rely on indirect approaches that aim to provide fine-grained data from which inferences can be made about mental representation. This requires that these approaches are not only robust and powerful, but also that they are appropriate to use with pictorial material.

A fundamental consideration in designing research methodologies for this area arises from the nature of the materials to be investigated. Diagrams and similar explanatory visual materials typically are used because they are considered better suited to the presentation of the subject matter than verbal formats (written or spoken text). It now seems clear that aspects of the information structure of diagrams can provide them with cognitive processing advantages over text (Glenberg & Langston, 1992; Larkin & Simon, 1987; Winn & Li, 1989). However, the great majority of research into the way people mentally represent information involves the use of verbal materials and verbally-oriented methodologies. There has been considerable development in the collection of detailed verbal data in recent years and approaches to analysis such as those discussed by Ericsson and Simon (1984) are well established. However, the direct adoption of such methodologies for the investigation of the way people deal with visual materials would require visual-to-verbal translations, so compromising their intrinsic visual character. In other words, collecting *verbal* data about the processing of *visual* material (for example, think-aloud protocols generated by a subject performing a diagram processing

task) would be of dubious value on its own (although it may be a valuable source of supplementary data). What is required instead are approaches that properly acknowledge the visual nature of these materials and deal with them without the need for any translation. So for an investigation of the way people deal with diagrams, it is not sufficient to confine the visual aspect of the procedure to the stimulus materials. It is important that the outputs that subjects produce should also be visual as should any intervening manipulations of the materials they perform. The need to use a consistently visual approach across the various aspects of investigation guided the development of the methodologies described in this paper. This development was informed by the approaches used by researchers in the investigation of cognitive aspects of various visually-oriented domains such as chess (Chase & Simon, 1973), architectural drawings (Akin, 1986), and electronic circuit diagrams (Egan & Schwartz, 1979).

Before dealing with specific aspects of the methodologies that have been developed for the current research program, some general considerations regarding this type of research will be discussed. For a methodology to be useful for fine-grained investigation of the way people interact with diagrams, it needs to be able to:

1. Display the diagrammatic material effectively to the research subjects,

2. Provide appropriate ways for the subject to interact with the diagram,

3. Capture detailed information about subject-diagram interactions,

4. Characterize these subject-diagram interactions with appropriate measures,

5. Permit generated data to be analyzed in a meaningful way,

6. Deal with static and dynamic components of the investigation.

As will be illustrated below, a suitable combination of the capacities of video and computer technology can address these types of needs in a variety of ways. In addition, the capacity of these technologies for dealing with dynamic data gives them a distinct advantage over more conventional (static) approaches to the reporting of results from this type of investigation.

Diagrams and Subjects

All the methodologies described here were applied to the study of how weather map diagrams are mentally represented. However, it should be noted that weather maps were used purely as illustrative examples of the type of diagram commonly used for instructional purposes (there was no interest in the investigation of weather maps *per se*). A discussion of the advantages of using weather maps for this purpose appears elsewhere (Lowe, 1990). In principle, the methodologies are applicable to a variety of diagram types from a wide range of technical disciplines. The two groups of subjects who participated in this research were individuals with either a high or a low level of expertise in the domain of meteorology, specifically professional meteorologists and non-meteorologists. Because it involved comparison of two groups with greatly differing levels of domain expertise, this research approach can loosely be described as fitting within the "expert-novice" paradigm (Chi, Glaser, & Farr, 1988). However, because the meteorologists were competent practitioners rather than acknowledged expert performers in their domain, the expert-novice characterization should be treated with some caution.

Data Collection

In the following sections, the use of two general types visual media technologies (computers and video) for the investigation of the mental representation

of diagrams will be discussed. Although these approaches were specifically developed for use with very abstract diagrams of a technical nature, there is no reason in principle why they could not be adapted for various other types of graphically-simple pictorial materials that are used as instructional illustrations.

Computer Technology

The computer-based methodology described here is an adaption and extension of an earlier manual technique that has been reported in detail elsewhere (Lowe, 1989). In general terms, the methodology was used to investigate a subject's mental representation for weather map diagrams by monitoring the way the subject explored an unfamiliar example of such a diagram which was initially hidden from view. This monitoring relied on the diagram having been segmented so that the subject's exploration across individual regions could be followed. A superimposed 6 x 5 grid divided the weather map into 30 square pieces (the diagram consisted of a map outline and its meteorological markings). When a subject began the experimental task, the display was completely covered with squares that were blank except for the map outline (i.e., no meteorological markings). During the task, the subject gradually revealed parts of the display by removing the covering squares from the display one at a time. This allowed determination of the order in which the selected regions of the display were inspected. However a condition of the task was that the subject was permitted to expose a total of only one third of the whole display (10 of the grid squares) and told that from this limited amount of information, she/he would later be required to complete the display.

In the computer implementation of this technique, the experimental task involved the subject interacting with a screen depicting a blank weather map of Australia and divided into 30 squares by a grid as described above (the map and grid were drawn in black on a white background). The subject was prompted through the required interactions by appropriate instructions provided in a side bar on the screen. To reveal what was under a particular square, the subject moved the computer's mouse pointer onto that square and clicked once, upon which the square turned black to signal that it had been selected. The subject was then able to either confirm the selection with a second click on the blackened square, or select a different square by clicking on it instead. The second (confirmatory) click on a square caused the hidden meteorological markings on that part of the weather map to be revealed. For any square exposed in this way the background was changed from white to grey so that the subject could easily tell that it had already been revealed (this was necessary since not all of square segments comprising the map actually contained weather map markings). As this revelation process continued, the instruction side bar gave the subject updated information about how many of the quota of 10 squares remained available for selection. Once all 10 of the allowed squares had been revealed, the subject's map showing the exposed meteorological markings was printed off. The subject then attempted to complete the whole weather map by drawing in any further meteorological markings that were thought to exist in the remaining 20 grid squares.

Because the interactions just described are somewhat involved, each subject was trained in the necessary operational processes before moving on to the experimental task. The sequence of presentation was as follows. After an introduction to basic processes such as moving and clicking the mouse, the subject was given preliminary training in the technique of revealing information by clicking on squares. This was done using a simple four-square grid (Figure 1).

Next, these skills were applied to a graphic display of a familiar scene (a simple house and its surroundings) following the same procedures that would be required for performing the experimental task with the weather map. The subject began with a bare outline of

the house divided by a grid of 30 squares (Figure 2) then by using the procedure described above for the experimental task, clicked on 10 squares in sequence to reveal one third of the house's details (windows, doors, etc.).

For this practice task, the subject's response was not printed off for completion. After this practice, the subject carried out the experimental (weather map) task with weather map. During the experimental task, the computer program recorded the identity of the squares chosen and the sequence in which they were selected. Finally, a screen dump of the subject's partly completed map (showing the 10 revealed squares) was printed off for the subject to complete (Figure 3).

This computer version of the original manual method was developed in Hypercard so that it was able to run on even low-end black and white Macintosh computers, thus making it suitable for use in a wider range of situations. Although some aspects of the methodology (such as the training segment) were altered to make the technique less dependent on the experimenter, the course of the experimental task remained fundamentally unaltered. The computer-based version has a number of benefits over the original procedure such as the automatic collection of data regarding which squares were chosen by a subject and their order of selection. It also has the potential to be used for displays other than weather maps as will now be explained. In the weather map version described above, the map outline constitutes one level of information (provided for the subject) and the set of markings that depict meteorological information constitutes another (to be provided by the subject). However, since the computer program is essentially a shell into which a particular display is fitted, the method could easily be adapted for investigating the way subjects search other diagrams that can be characterized in terms of two levels of information. For example, in the area of biology, subjects could be presented with an outline of an unfamiliar animal's body and the way they searched for hidden details of the animal's digestive system studied. Similarly, in the area of electronics, subjects could search for information about the components present in a hidden section of a circuit diagram.

Video Technology

The methodology described here was developed to obtain finer details about the mental representation of weather map diagrams than could be obtained from the technique described above. In addition, its basic approach to data collection was fundamentally different, thus providing the opportunity for triangulation. A video recorder was used to capture the sequence of actions performed by subjects in carrying out tasks involving a previously unseen Australian weather map. A major part of the process involved subjects drawing a copy of the map's meteorological markings onto a blank map. However, the weather map they were to copy was not continuously visible. Instead, subjects could only view the stimulus map while they were pressing a button with their drawing hand. This meant that they could either take a look at the stimulus map or draw markings onto the blank map but not continuously view and draw at the same time. Hence, subjects were forced to alternate viewing and drawing in a succession of discrete actions. An indicator light was switched on when the viewing button was pressed and remained illuminated for the duration of each viewing period (i.e., as long as the viewing button was depressed).

The subject carried out the experimental tasks at a specially constructed table that had a glass window inserted into its top with a mirror set beneath the window at an angle of 45 degrees. A video recorder aimed at the mirror allowed each subject's drawing behavior to be recorded from below without obstruction (the response sheet containing the blank map was made from tracing paper so that the subject's drawing was visible from below). The viewing indicator light was positioned so that it could be included in the area being

recorded by the video and the camera was fitted with a counter that marked each frame with elapsed time. Thus in addition to recording the subject's drawing of each meteorological marking, the length of each viewing period was automatically recorded on videotape. As well as drawing a copy of the weather map, subjects later drew what they could recall of the map's markings. Video records of this process were also made to enable comparison of the intake of diagram information (during copying) with its output (during recall).

Data Analysis

Two main types of data are collected by the techniques that have been described. The first are *process* data which come from the actions subjects perform during an investigation as they work through a task. Of particular interest here are the temporal order in which the meteorological markings are processed, the location of those markings, and the durations of various stages that comprise the processing. The second type are *product* data such as the outcomes (drawings) of copying, recalling, or completing a weather map.

Analyzing each type of data presents its own challenges, some of which concern practicalities such as how to carry out particular measurements while others concern more fundamental theoretical issues involving the choice, treatment, and interpretation of those measurements. Some examples of the way process and product data were handled during analysis will now be presented.

Process Data

A number of assumptions were made here. First, it was assumed that the temporal order in which the meteorological markings were processed was in some respects influenced by the nature of the mental representation of the weather map information. This assumption parallels that made by Taylor and Tversky (1992) in their investigation of the mental organizations of environments. As these

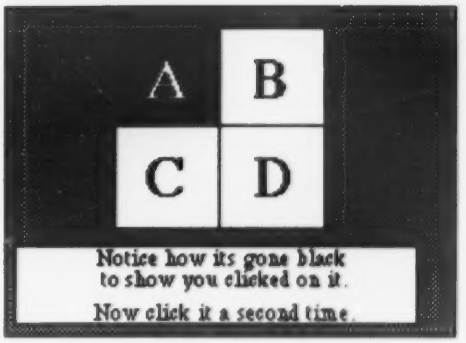

Figure 1.
Grid used for training subjects in procedure for selecting squares (black indicates square 'A' has been clicked once; a further click would reveal what was under this square).

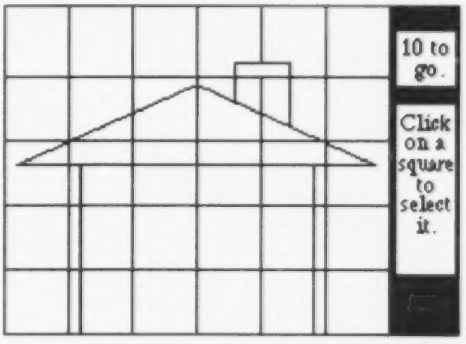

Figure 2.
Practice task graphic showing outline within 30 square grid. Note instructions to subject in side column.

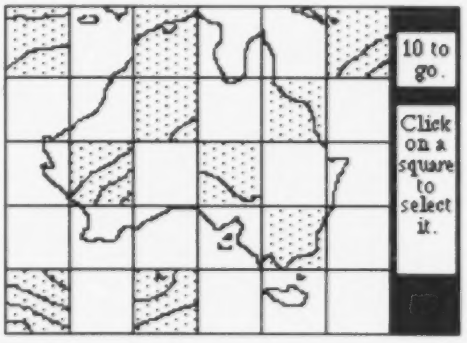

Figure 3.
Screen dump showing markings on a subject's 10 selected squares. Subject would next attempt to complete the map' markings.

authors have observed, one of the research difficulties in using drawings as data is how to score them. Taylor and Tversky used the order in which elements of a map are drawn as an index of organization on the assumption that the clustering of items in a recall sequence occurs because those items are closely related in some way. In the video-based weather map investigations referred to in the present paper, this type of clustering assumption was made about the sequences produced during the copying of items as well as during their recall. In the computer-based investigation mentioned earlier, assumptions about clustering were made from the order in which the 10 squares were selected for revelation. Depending on the particular task a subject was performing, the structure of these sequences may provide an indication of matters such as the effects of established habits of perceiving and drawing, the extent of visual impact (in perceptual terms) of different types of markings, the tendency of subjects to group the markings because of similarities in their visuospatial characteristics, the ease with which markings of different types were processed or the relative meteorological importance attached to different markings.

The second assumption was that the relative durations of particular aspects of processing (such as the lengths of viewing periods) were of significance. In the current context, this assumption concerns only the video-based investigation described above. On most occasions during the copying task, subjects viewed the stimulus diagram using a series of relatively short glimpses. After each glimpse, a subject typically drew one or more marks. However, at various stages during the process of copying the stimulus diagram, the subject would spend a much longer time gazing at the diagram before changing to drawing. These longer viewing periods were interpreted as indicating the start of a new phase of processing in which the subject's attention shifted to a different group (or chunk) of graphic elements within the stimulus diagram. This interpretation permitted each subject's processing sequence to be used to identify subsets within the complete set of graphic elements comprising the diagram. By examining the constitution of these subsets, inferences could be made about inter-element relations that might be involved in the subject's mental representation of the diagram as a whole. For example, it appeared that the non-meteorologists structured the mental representation of information in the diagram on the basis of relations involving the visuospatial characteristics of the markings themselves whereas the meteorologists' structuring was based upon relations that reflected the meteorological significance of these markings.

A major disadvantage of the process aspect of the video-based investigation was the time consuming and labour-intensive nature of the data transcription required. The raw data consisted of a videotape record of each subject's viewing and drawing behavior in which each videotape frame was marked with the time elapsed since the start of the task. In addition, the videotape of the copying task also contained records of the periods during which the viewing indicator light was switched on and switched off. Transcription of the videotape involved locating precise frames at which (a) the viewing indicator light was switched on or was switched off and (b) the subject's pencil just began to draw a mark or just finished drawing that mark. The elapsed time for each of these frames was transferred manually to build up a table that set out each subject's viewing and drawing behavior. In addition, each of the marks drawn on the map was labelled with its position in the overall drawing sequence. In contrast to the video-based investigation, the computer-based investigation described earlier automatically collected process data about the identity of the 10 squares that a subject revealed and the order in which they were selected. These data required no pre-treatment after collection and were ready for immediate transfer to a statistical analysis program. However, the

computer-based approach did not offer the same opportunities for collecting the subtle types of data that can be captured by the use of video. Clearly an integration of the capacity of video technology to collect detailed visual data and the automatic data collection capacity of computer technology would be the ideal combination.

Product Data

Map markings drawn by subjects and the larger graphic structures formed by the conjunction of drawn and existing markings can be characterized by various measures. These measures allow a range of comparisons to be made including those between (a) the markings on the stimulus materials and those produced in the subjects' responses, (b) different classes of subject (such as experts and novices) and (c) products generated at different stages of an investigation (such as copied and recalled markings). Measures of position, size, shape, and orientation are useful to characterize the properties of individual markings both in terms of their basis visuospatial properties and in terms of the meteorological significance of those markings. For example, the sizes and relative positions of markings in of a set of concentric closed isobars that together constitute a cyclone not only show the physical extent of that feature, they also indicate its likely severity. As well as making measurements of each marking on its own, it is important to characterize larger composite structures made up of two or more markings which constitute meteorologically significant assemblies.

A fundamental matter to be resolved in developing an analysis procedure is the definition of what constitutes a discrete entity for the purpose of analysis. In cases where a marking consisted of a single graphic stroke or a set of physically connected strokes, this generally did not constitute a problem since it was usually quite clear that a single entity was intended. However, for other markings such as a cold front symbol, physically connected but geometrically distinct markings were considered as separate entities because pilot studies showed that these different components were drawn by subjects as a number of separate subgroups (in the case of a cold front, a line plus a group of triangular barbs).

Once individual graphic entities have been defined, the next problem is in making measurements of the position, size, shape, and orientation of each entity. Recent developments in image analysis computer software have greatly simplified this measurement task. These programs process an image that has been converted to digital form and then use various algorithms to characterize properties of the image. In the case of the weather map diagrams used for the research referred to here, the image was captured by means of a flatbed scanner to form a disc file (in a format such as PICT). Some preliminary treatment using image enhancement software was usually necessary to clean up the scanned image and to prepare it for analysis. For example, regions bounded by particular sets of lines might be filled with "paint" to isolate them so that the image analysis program can later identify them as distinct features to be measured (each such region is typically described as a "blob"). Once the prepared image is loaded into the analysis program, the user can then specify the desired measurements and select the blobs of interest. Simple measures of distance (such as length or perimeter) and area are made by counting pixels which are then converted into more familiar units. The position of a blob is based upon its center of gravity while a variety of measures such as symmetry, roundness, and the ratio of the axes of the best fitting ellipse help to characterize its shape. For orientation, a measure of the inclination of the longest axis of the best fitting ellipse can be used. Data from these measurements are readily transferred to statistics packages for further processing.

Reporting Results

A combination of the capacities of computer and video technologies has enabled the findings obtained from the types of investigations described above to

be displayed in a manner that is more appropriate than conventional methods. This is particularly well demonstrated in the case of results obtained from analysis of the process data where the nature of the subjects' performance over time was of special interest. For example, a computer animation program was used to produce dynamic summaries of essential differences in how those in the meteorologist and non-meteorologist subject groups built up the meteorological markings as they copied a weather map. These summaries collapsed the individual marking sequences produced by subjects within these two groups into an overall sequence for each group as a whole. In addition, the animation greatly compressed the time scale so that the broad temporal patterns present in the sequence became much more apparent. Once prepared, the animated sequence for each of the subject groups was transferred to videotape for easy presentation and distribution. This animated form of the results captures process aspects of the subjects' performance far more faithfully than is possible in a static figure of the type typically used to report the findings of an investigation. Further, complex results of the type generated in this investigation appear to be considerably more accessible if presented in an animated format than if presented in a more conventional manner.

Conclusion

This paper has dealt with several illustrative examples of how video and computer technology can be used to support basic research into the way diagrams are represented in people's minds. The approaches that have been developed can address a variety of challenges that face the researcher in this field, ranging from those of presenting the initial stimulus material to subjects through to reporting the research findings in an appropriate manner. In common with other research methodologies, in order to make use of these approaches effective, sufficient attention must be given to theoretically significant aspects of data collection, analysis, and interpretation. The strength of video technology is that it provides for the capture of highly detailed visual data. However, it also presents problems with the time-consuming nature of some aspects of transcribing the generated data into a form suitable for statistical analysis. In contrast, computer technology can directly monitor some aspects of a subject's performance and save the generated data in files that are suitable for analysis by a statistical package without further processing. Unfortunately, it is not currently capable of directly providing (for reasonable cost and effort) the type of facilities for dealing with visual data that are available with video. However, the recent merging of video and computer technologies with the advent of digital video opens up exciting possibilities for developing a whole range of new research tools that can be used to increase our understanding of the way people deal with visual information.

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PRIVACY IN THE COMPUTER AGE: PERCEPTIONS AND REALITIES

by
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One aspect of visual literacy is computer literacy. As more and more people become computer-literate, issues of privacy are being raised more often. These issues involve individual rights, national concerns, and international cooperation. This paper begins with the identification of major privacy issues at the individual, national, and international levels. The issues identified in the first part of the paper provide the basis for the second part of the paper, which is a report of a survey in which subjects were asked to indicate whether they felt the issue was significant in general, and the extent to which they personally felt affected by the issue. The paper concludes with a discussion of results and implications for further study.

Almost everyone in contemporary society has some contact with information technology. From computers that generate utility bills and digital switching devices on long distance telephone calls to sensors on traffic lights that control traffic flow, computers are occupying a central role in our lives. In addition, ample evidence exists that information technology will continue to expand in the years ahead.

Theoretical Perspective

Several researchers have identified areas in which information technology will continue to have an impact on everyday live. Williams (1984), for instance, identifies the following: the growth of the "information business;" transportation; governance and politics; health care; work; leisure; education; and national development and world order. In his analysis, Bell (1973) focuses on the changing character of work in the information economy. Citing the shift from an industrial-based to a service-based economy, he notes the central role of computers and information. Toffler (1981) also places the computer at the center of his vision of "electronic cottages," the workplace of the twenty-first century. Dutton, Blumler, and Kraemer (1986) identify the "wired city" to describe ways in which households and businesses in urban areas will benefit from the increasing use of information technology. Thus, regardless of the specific application of technology, consensus has been reached on the increasing impact of information technology in all areas of life.

Computer literacy is also an important area within the general topic of visual literacy. Compaine (1988) links these two areas when he notes that skills in information technology will be required in order to function in society. He also argues that this form of literacy will supplement rather than supplant other definitions of literacy. He further compares traditional definitions of literacy, in which he includes devices such as the printing press and the steam engine, with changes in the way in which people think about conceptualizing and processing information as a result of information technology. In other words, to be computer-literate, one must be a computer user, but not a computer programmer.

Education is one area in which the growth of information technology has had a great impact. From preschoolers who are introduced to computers, to research universities with the availability of supercomputing, computers are being integrated into education more and more. Estes and Williams (1988) cite four reasons for this. First is the demand from parents, school boards, and citizens for computer instruction in the classroom.

Secondly, decreasing costs for personal computers have resulted in greater numbers of p.c.s. being purchased by educational institutions. Thirdly is the ease of interactivity of this technology with other forms, including printers, videodiscs, videotapes, etc. Finally, the instructional process itself can be improved through individualized instructions, which has become more feasible with the growth of information technology. In short, computers are being used by more students at all levels. For many students facing the workplace of the twenty-first century, familiarity with information technology will be a necessity in order to compete in the global market.

These information technologies, however, do not exist in a vacuum. They are being developed and integrated within existing political, economic, and social concerns and issues (Gillespie & Robins, 1989). One of the most commonly-cited areas of concern is privacy. Although the role of privacy in the computer age in general has been widely-studied, specific privacy issues or threats to privacy are continually being raised. Mendes (1988) guides readers through a myriad of definitions of privacy, ranging from constitutional, common-law, and statutory definitions, to five major types of privacy concerns. She modifies Westin's 1967 definition of privacy to arrive at the following definition: "a condition in which individuals, groups, or institutions can determine for themselves, when, how, and to what extent private information about them is communicated to others." In accepting this definition for privacy, this author believes that such conditions can be either real (occurring in the external world) or perceptual (people believe them to be real, even without external verification). Definitions of privacy that include both real and perceptual dimensions is not without foundation. In 1984, a study conducted by Louis Harris and associates (1983) found that people in the United States not only believed that the centralization of information from many sources is possible with computers, but it is also a threat to personal privacy. In a more recent study, Gandy (1989) warns about the increasing use of automated methods of surveillance devices as potential sources of threats to the individual. Although Gandy is most concerned about privacy at the individual level, concerns occur at the national and international levels as well.

At the individual level, questions continue to be raised about the safeguards to the individual's right of privacy in a technological age. Recognizing that many Western governments have acknowledged and established rights to privacy in their political and/or judicial systems, these researchers cite the protection of privacy as a fundamental issues. While agreement seems to exist on the need for data acquisition, privacy concerns generally are raised on rights to access to the data once it has been gathered (Schirmacher, 1986). Such concerns range from information in data banks, which might be used by business or government, to information which a "hacker" might discover on an individual's personal computer.

At the national level, privacy issues are most closely related to the issues of security. Different nations in the world community have taken different approaches to these questions. In the United States, for instance, many early technological advances have been developed for strategic/military purposes, or matters of national security or national defense. At these initial stages, funding has come primarily or exclusively from the federal government. As the technological innovation expands beyond its defense-related applications, subsequent development shifts from government to business and industry. On the other hand, the governments of several European nations have taken a more central role in information technology development. Although policies and practices vary, in general, the role of government in information technology has been more direct in Europe (Monfils & Monfils, 1991). In Japan, too, direct governmental involvement has been clear and significant.

At the international level, issues of privacy become even more complex. They include not only the validity of information being transmitted across international boundaries, but also its ownership. Concerns have also been raised as to the rights, responsibilities, and protections that people have in trans-border data flow. For instance, do law enforcement agencies in one country have the right to share information with their counterparts in other countries, or does this violate the individual's right to privacy? What accountability exists with the way in which the receiving agency uses this information? Does the individual have a right to be notified? What about issues that are in the common interest, such as sharing information about possible terrorist groups or organizations? These issues are far from being settled (Monfils & Monfils, 1991).

Thus, a synthesis of research has led to the identification of privacy concerns at the individual, national, and international levels. These concerns relate to rights to privacy, protection from access by unauthorized persons or agencies, national defense, and international laws and cooperation. To what extent these concerns are actually being perceived by individuals is the focus of this research study.

Method

As computers are introduced more and more into education, students become the beneficiaries of these technological advances. As students become more experienced users of information technology, they should understand the limits of technology in regard to privacy. This study was done in order to provide answers to the following research questions:

1. Are university students using computers on a regular basis?

2. If so, what concerns regarding privacy do university students have?

3. Do relationships exist between the amount of technology use and level of concern of privacy at the individual, national, and/or international levels?

4. Is the perception that computers are likely to invade, or have already invaded, personal privacy related to concerns over specific types of privacy issues--i.e., individual, national, and international concerns?

To answer these questions, a survey was distributed to 145 university students in the Midwest in the U.S. In order to make the sample more broadly representative, questionnaires were distributed to students at all levels in their university studies, ranging from freshmen to graduate students, and to students in day and evening classes. Moreover, they were distributed to students on two different university campuses, one primarily a resident campus and one in which more than half of the students do not live on campus. Data collected from these surveys was analyzed using Release 4.1 of SPSS (Statistical Package from the Social Sciences). In this questionnaire, students were asked to indicate how often they used several forms of information technology, ranging from programming a VCR to using a personal computer. These questions formed the basis of a "Uses" subscale. They were also asked to indicate if they owned a personal computer or had taken a course with hands-on computer training. They were then asked to indicate how much of a concern they felt on invasion of privacy by computers in general, and on twenty specific privacy-related issues. Responses were based on a scale from "not likely at all to happen" to "has already occurred." These questions became the "Concerns" subscale. Demographic information on gender, age, major, and year in college was also gathered. Alpha coefficients were computed for the entire instrument and for the Uses and Concerns subscales of the questionnaire, with scores of .67, .78, and .93, respectively.

Results of this survey confirmed that

most university students use computer technology regularly, i.e., at least once a month. **Forty-one** per cent said they played computer games regularly, while **eighty-three** per cent said they used a personal computer for purposes other than playing games at least once a month. **Forty-seven** per cent said they used the mainframe university computer regularly, and **thirty-six** percent regularly used a mainframe computer at work. **Forty** percent of those surveyed said they owned a p.c., and **one-half** said they'd taken or were taking a computer course with hands-on training. Thus, in this study, most students use personal computer on a regular basis.

Students were than asked to indicate to what extent they felt concerned about certain issues related to privacy. Questions were asked relating to concerns at the individual, national, and international levels. Specific applications included banking, telephone services, grades, insurance, employment screening, law enforcement, and airline reservations.

For concerns at the individual level, the question receiving the highest number of responses as being very likely to happen or has already happened was the question of access by law enforcement agencies (**87%**), followed by insurance companies (**71%**), access to academic records (**52%**), driving records (**51%**), and access to credit card numbers by unauthorized persons (**50%**). Students showed the least level of concern that a computer hacker could learn things about them (**7%**).

Three questions were used to assess level of concern in regard to privacy on a national level--the government, the Internal Revenue Service, and national security agencies. Respondents split fairly evenly on both sides of these three questions, with **27** per cent expressing little or no concern about the government's having excessive information on them, **23** per cent expressing little or no concern about the IRS, and **30** percent expressing similar sentiments about national security agencies. On the other side, **47** percent said it was likely to happen or has already happened that the government has excess information on them, **52** percent responded similarly about the IRS, and **46** percent said national security agencies either have or were likely to have excessive information.

Respondents were also asked to indicate how likely it was to happen that international governments and international law enforcement agencies can learn information about them through information technology. Responses ranged from **30** percent as not at all likely or unlikely to happen to **36** percent who viewed this as likely to happen or already happening in reference to international governments. When asked about international law enforcement agencies, **29** percent said it was not at all likely or unlikely, while **48** percent said it was very likely or had already happened. Thus, students expressed concerns on issues related to privacy at the individual, national, and international level, with some issues at the individual level being perceived as more likely to happen than others.

Pearson product-moment correlation coefficients were computed to assess relationships between amount of technology use and concern over privacy issues. This was assessed in two ways: by individual uses of computers and by a combined category called general use. The general use category was determined by combining four types of computer use--game-playing, p.c. use, or mainframe use, either at the university or at work. Statistically significant relationships were found in many categories.

For instance, a significant direct relationship was found between those who regularly play computer games and the concern over access by law enforcement agencies (**r = .165; p = .05**). A significant **inverse** relationship occurred between those who regularly use a personal computer for purposes other than game-playing and concern over access by

law enforcement agencies (**r = -.265; p = .01**). Similar concerns were seen among those who regularly use a mainframe at work (**r = -.207; p = .05**). Non game-playing regular users of personal computers were also found to have a significant **inverse** relationship with the concern over access to high school or university grades (**r = -.218; p = .01**), while work-related mainframe use **inversely** correlated with concerns over records in data banks (**r = -.235; p = .01**). The same **inverse** relationship was seen between those who regularly use a mainframe at the university and concern over records in data banks (**r = -.189; p = .05**) and the concern of unauthorized changing of scores on computer games (**r = -.170; p = .05**). **Direct** relationships were established between the combined category of general computer use and concerns over access by law enforcement agencies (**r = .1951; p = .05**) and records kept in data banks (**r = .1932; p = .05**). An **inverse** relationship was detected among general uses and concerns that others could learn telephone calling card numbers (**r = -.1817; p = .05**). On the other hand, **no** statistically significant correlations were found between ownership of a personal computer and privacy concerns. **Inverse** relationships were found between taking a class with hands-on computer training and the following two concerns: law enforcement agencies (**r = -.182; p = .05**) and computer hackers (**r = -.168; p = .05**). **Direct** correlations were found between levels of computer anxiety and the following concerns: unauthorized access to driving records (**r = .234; p = .01**); unauthorized access to grades (**r = .237; p = .05**); unauthorized access to bank records (**r = .201; p = .05**); unauthorized access to credit card numbers (**r = .190; p = .05**); insurance companies (**r = .253; p = .05**); unauthorized withdrawal of funds from bank accounts (**r = .207; p = .05**); international governments (**r = .196; p = .05**); and international law enforcement agencies (**r = .235; p = .05**).

The fourth research question was whether relationships existed between perceptions of invasion of privacy by computer technology and specific privacy concerns. Pearson correlations were computed between responses to the item, "My personal privacy is invaded by computer technology," and each of the twenty specific concerns. Statistically significant direct correlations were found for **all** twenty applications.

Results are as follows:

concern over: access to driving records (**r = .398; p = .01**); unauthorized access to grades (**r = .343; p = .01**); unauthorized access to bank records (**r = .341; p = .01**); unauthorized access to telephone calling card number (**r = .303; p = .01**); unauthorized access to credit card number (**r = .246; p = .01**); insurance companies (**r = .326; p = .01**); prospective employers (**r = .331; p = .05**); law enforcement agencies (**r = .213; p = .05**); computer hackers (**r = .269; p = .01**); computer's keeping track of who and when phone calls are made (**r = .194; p = .01**); records kept on computer data banks (**r = .406; p = .01**); unauthorized alteration of scores on computer games (**r = .190; p = .05**); unknown people know a lot about me because of computer data banks (**r = .338; p = .05**); unauthorized withdrawal of funds from bank account (**r = .323; p = .01**); the Government (**r = .278; p = .01**); The Internal Revenue Service (**r = .274; p = .01**); national security agencies (**r = .290; p = .01**); international governments (**r = .261; p = .01**); international law enforcement agencies (**r = .272; p = .01**); and airlines (**r = .370; p = .01**).

Discussion

This study revealed several significant aspects. First, university students in this study were shown to be high users of computer technology, whether for relaxation, school, or work. Secondly, students expressed concerns about privacy issues at all levels,

individual, national, and international. While hands-on computer training may lower concerns about computer hackers and computers that keep track of phone calls, as level of computer anxiety increases, so, too, do concerns over driving records, grades, banking records, insurance, international governments and international law enforcement agencies. However, the most revealing aspect of this study was the extent to which general perceptions of invasion of personal privacy by computer technology have a significant, direct relationship to individual, national, and international concerns.

This study, however, is limited by certain factors. University students in this study regularly use computers to a greater extent than in several other studies, which suggest that many university students do not regularly use computers. Similarly, reported levels of computer anxiety in this study were less than other studies, some of which suggest that up to one-third of university students may be computer-phobic (DeLoughry, 1993). In addition, this study used self-reports of anxiety level, rather than applying other forms of measurement. Thus, the generalization of results from this study may be limited.

The relationships between computer literacy and ethics have yet to be fully documented. This study confirms research that significant relationships do exist between computer use and concerns over privacy issues. It is a topic that bears not only watching, but also assessing, as information technology continues to expand into the everyday life.

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COMPREHENSIBILITY

by
Rune Pettersson

Some people are continuously in the process of creating documents such as PMs, messages, instructions, reports, descriptions, and course literature. Some of these documents are meant only for distribution within limited groups, while others will be spread to many different readers both inside and outside the company. However, because any author's intended message may be interpreted in different ways by different readers, problems arise. In some cases, readers do not understand the documentation at all.

It is difficult to create easily understood information. On the other hand, it is simple enough to require ease of comprehension. But what is actually implied when we say that a message is comprehensible?

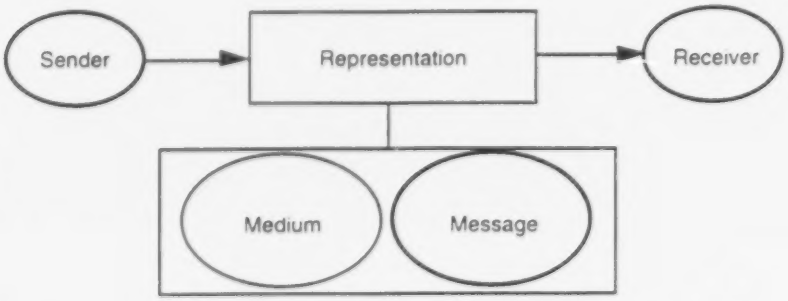
To someone working with information, it is not sufficient that a message be produced and transmitted, as in radio and television, nor is it sufficient that a message be produced, transmitted, and received by an audience. The act of communicating is not complete until our message has been both received and understood by the audience. In other words, our messages must always be comprehensible, otherwise they will have no effect.

Communication

Communication takes place when a sender wants to convey one or more messages to one or more receivers. The sender transfers the messages to the receivers with the help of different media. A medium and its contents (the message) constitute a *representation*.

In this report, I shall focus on formulating the message. As the reader will see, the discussion of comprehensibility is fundamentally applicable to all media.

On occasion, unfortunately, communication does not seem to function. This may depend on insufficient information, but it may also be because we have difficulty reaching each other. By way of example, the following title is cited as a warning in "The Technical Writer's Handbook" by Matt Young (1989): "Conditional symbolic modified single-digit arithmetic using optical content-addressable memory logic elements: Conditional symbolic modified signed-digit arithmetic operators" (p. 206).



Communication. A *representation* is a medium with a specific message. The sender transfers his message to the receiver with the help of a medium.

Esoteric and impenetrable jargon like this can be perceived as incomprehensible by the uninitiated. Since readers who do not know the code are left out, its use poses the risk of "one-way only" communication, and has no value outside of initiated circles. We find it unsettling when experts speak down to us; it puts us into a defensive frame of mind, and may even cause us to become obstinate. Interaction analysts describe this as a "You're OK, I'm not OK" reaction. However, what we should be striving for is a "You're OK, I'm OK" situation.

When a document is to be read and understood by several people, there is ample reason to expend effort on achieving a good quality of information. When this is achieved, we can discern the information's esthetic, informative, pedagogical, and technical qualities, and sometimes even its entertainment value. Good information quality can be defined as the degree of congruity between the sender's and the receiver's subjective perceptions of the information, as well as of the reality that the information represents. By investing resources in improving the quality of information, we can achieve better product and project quality, while at the same time making large cost savings.

It seems as though arcane, abstruse texts have become a global problem in technical and scientific documentation. Kirkman (1992) opens the first chapter of his book "Good Style" with the following two paragraphs:

> It is surely axiomatic that the aim of technical writing is to transmit information accurately, quickly and economically from one person to another. Then why do so many scientists and engineers make their writing so heavily unreadable? Obviously, their subject matter is sometimes complex and conceptually difficult; but frequently the 'unreadability' stems from the use of a style that makes the reader's task much heavier than it need be. (p. 2)

Good documentation implies very good comprehensibility and low cost, as well as ready accessibility when it is needed--and only then, in fact. Poor comprehensibility causes the receiver's confidence in the sender to diminish, and heightens the risk of unsound decisions being made. Many good suggestions may be rejected because those whose job it is to determine their practical merit simply do not understand what the suggestions call for.

Comprehending means understanding the immediate or fundamental meaning of something. A message is comprehensible if it can be grasped without difficulty. Whether a message--for example, a technical report--can be understood or not is dependent on many different factors, of which some relate to the sender, others relate to the message or representation, and still others relate to the receiver (see the picture on the next page).

Speaking and writing are language-related activities performed by the sender. These activities are influenced by the sender's earlier observations, as well as by his terminology and the language he uses. Besides being *active*, the sender is in charge of *encoding* the message, i.e., its production and distribution.

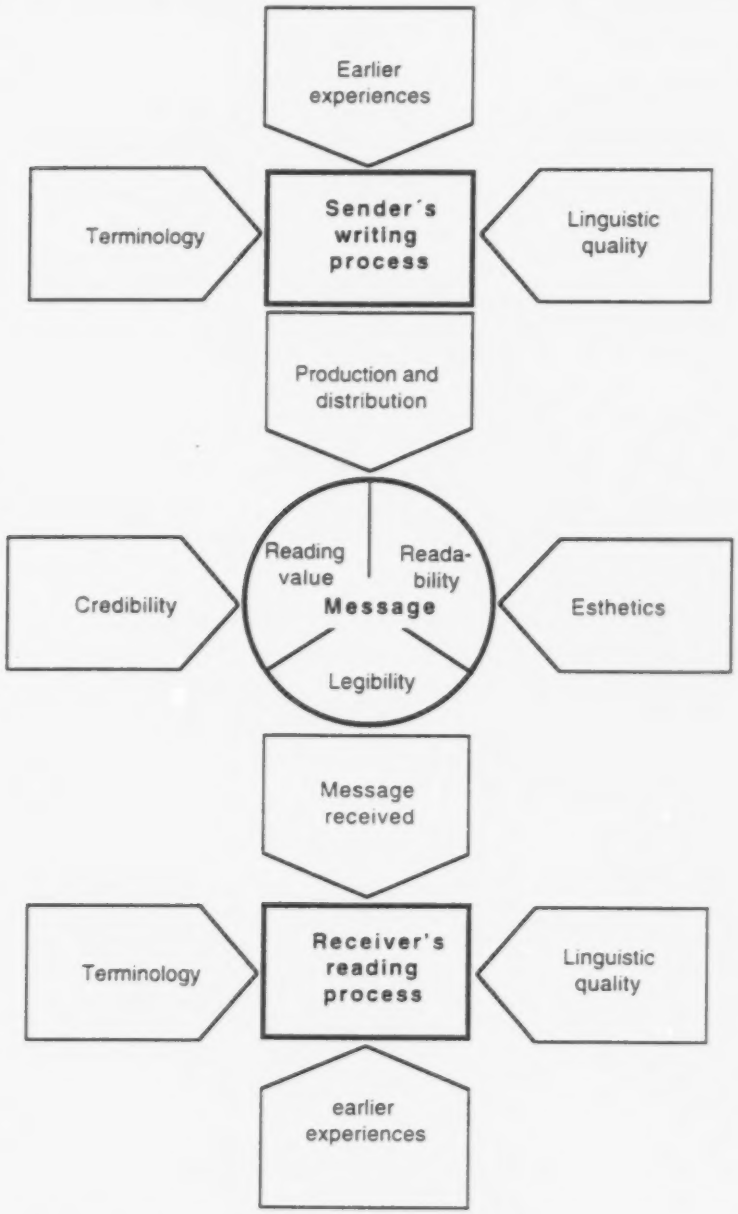
Listening and reading are language-related activities performed by the receiver. As is the case with the sender, the receiver's activities are influenced by his earlier observations, as well as by his terminology and the language he uses. Besides being relatively *passive*, the receiver is in charge of acception and *decoding* the message.

The picture on the following page shows a model of comprehensibility with a graphic verbo-visual message as an example. This model is also applicable to oral communication and communication via audio-visual media.

The readability, legibility, and reading value of the graphic message are of decisive importance to the receiver's

ability to understand it. (Audibility, distinctness, and listening value are of similar importance to the understanding of oral texts.) Moreover, these factors--besides being influenced by the writing process--are all prerequisites for the reading process.

Therefore, we shall attempt here to show the relation of readability, legibility, and reading value, as well as credibility and esthetics, to the message rather than to



Comprehensibility. Our ability to understand a verbo-visual message (for example, a technical report) is dependent upon its readability, its legibility, and its reading value. Comprehensibility is influenced by the message's credibility and esthetics, by the sender's writing process and the receiver's reading process.

the sender or the receiver. By proceeding from the writing process (i.e., the terminology of the message, as well as its credibility and linguistic value), we shall try to analyze how we can achieve greater comprehensibility.

It is clear that we must help those who work with documentation, information, and training to become better writers themselves, a goal that will also require the help of professional technical instructors, translators, graphics experts and designers. By developing explicit terminology, we can make things easier for writers as well as for their readers.

Experiences

Texts and pictures may be either easy or difficult to interpret. The degree to which they are one or the other can depend on several different factors. If, for example, a reader lacks the background knowledge in a given field that is required in order for him to interpret a text, then there is no chance that he will understand it, no matter how diligently the writers, instructors, graphics experts, and designers exert themselves. The same will be true if the reader's command of the language used is poor.

Everyone learns to read words, but we must learn to *read pictures* (Pettersson, 1989) as well. Therefore, pictorial *language* must be adapted to the viewer's capacity for interpreting it. Communication can be said to function successfully between the picture-maker and the viewer if the viewer understands, to the fullest extent, what the picture-maker wants the picture to say, and if the message conveyed is unambiguous.

Gunnarsson (1982) discusses specific reader characteristics from the perspective of the *schemata theory*, which is based on the premise that we store our impressions of our surroundings in the form of schemata. The theory postulates that we have different partial impressions, such as general knowledge about different types of text, as well as different whole impressions of reality. Our deeper understanding of a text is influenced by the schemata that we bring to the fore when we read.

A few brief glances at a picture are enough for us to recognize it again among other pictures. Shopping in a department store, for example, we are passively conscious, i.e., we know, that there are a great many advertisements in the form of pictures and text--and usually background music as well--all around us, even though it all fuses into something our senses perceive as noise. It is plausible that we process most of these stimuli at a superficial level: We see and hear, but we do not look or listen. To examine this more closely, let us imagine five cognitive mental levels arranged like the steps of a staircase (Pettersson, 1989):

- creating text, pictures, music
- analysing text, pictures, music
- reading text and pictures, listening to music
- looking at text and pictures, hearing music
- being aware of the presence of text, pictures, music.

Looking at a picture expends more mental energy and demands a higher cognitive level than merely seeing that a picture is there. Similarly, listening to music requires more concentration than hearing background music. These impressions, on being received, are conveyed from the sensory memory to the short-term or *working* memory. Some of the information proceeds on through the filtering system and becomes consciously perceptible to the receiver. However, after a short while, most of this information disappears.

When we study, we take an active part in the contents of the material. We read texts, we listen to music, we read pictures. This consciously perceived information is processed, sorted, and stored in certain parts of our long-term memory. In the case of a picture, we may need to focus on different portions of it a number of times (so-called *eye fixations*) to be able to describe it later on.

Conscious analysis of verbal messages requires even greater expenditure of mental energy and demands a still higher cognitive level. Most demanding of all are the creative processes that make it possible to create texts, music, and pictures. Authors, composers, and artists all bear witness to the mental strain that can be a part of the creative process. The cognitive model with its five levels, as shown above, presupposes a dynamic mental process in which we change cognitive levels both consciously and unconsciously.

Our sensory organs react to changes in our surroundings. Normally, we can perceive changes (in spatial properties, for example) that are greater than about two percent. On the other hand, we adapt ourselves to slow, gradual changes, so that we barely notice them at all. Our normal condition, therefore, is a state of mental repose that affords us the capacity for sudden, rapid activity. Correspondingly, we cannot keep ourselves at the highest cognitive levels for more than a limited time; the effort would require too much energy and would probably induce some kind of mental *cramp*. Like a pike lurking among reeds, or a cat spying outside a mouse's hole, we know what our surroundings look like. If something happens to change some familiar element in our milieu, we can react swiftly and decisively, impelled by a rush of mental and physical energy. Sometimes things turn out fine: The pike gets his minnow, the cat gets her field mouse, and we find the information we are looking for. But things can turn into a muddle, too: The predators fail to capture their prey, and we end up wasting time and energy trying to make sense out of uninteresting information.

Because they influence us in an emotional way, pictures have an enormous impact. Children, for example, can be easily frightened by violent action on television, but they are not upset by reading about violent action in a book. This is in part because what we see seems more tangible to us than what we read, but it is also because reading a text requires a higher cognitive level than viewing a picture does. Several researchers, among them Tröger (1963) and Noble (1975), have demonstrated that very small children are incapable of taking an active part in the content, or understanding the context, of material shown on a television screen. Most parents with toddlers have made the same observation.

There are no fixed or distinct borders between the five levels of our cognitive model. Depending on cultural, social, and intellectual factors, there may be great differences between various persons' ways of conforming to the model. Then too, mood, health, surroundings, and a number of other circumstances can cause one and the same individual to react very differently at different times. However, what the model reveals is that there is in fact a great difference between the concepts of seeing--looking--reading and hearing--listening.

Actively taking part in a linguistic message that consists of text, sound or pictures, either together or separately, always implies the exertion of effort, i.e., work. Reading or listening taxes our faculties; sooner or later we become tired. Furthermore, material that is poorly constructed and/or presented strikes us as dull, and not only causes our interest in the subject to wane, but leaves us exhausted.

This applies irrespective of whether a message is meant to impart information, instruction, or entertainment. It also applies irrespective of the medium of conveyance, except insofar as different media have entirely different capacities for

conveying a message from a sender to a receiver.

Strömquist (1991) points out that we all have proficiency in, and insight into, the labours of writing. We all know how writing is done. We know that *the writing process* consists of more than simply committing words to paper; indeed, it presupposes long-term memory and familiarity with the things that have to do with writing. In other words, writing is an extensive, time-consuming, dynamic, gradual, cognitive, and strenuous business.

The Writing Process

The section *Writing Advice* contains concrete instructions, i.e., rules of thumb, on how to write so that your text will be understandable.

The physical act of writing down one's thoughts with the help of a pen or a keyboard does not usually require a great deal of time. It generally takes longer to think what the text should consist of than to formulate it. Thus, the writing process encompasses much more than merely writing, and it is relatively independent of the language used. We work more or less the same way when we write English as when we write Swedish or any other language.

Before we begin writing, we need to identify the subject and define the purpose of the message. This always requires analysis of the target group or receiver. Receiver analysis might contain evaluation of the receiver's basic understanding of the subject, his trade knowledge, experiences, skills, comprehensive capacity, attitudes, prejudices, motivation, linguistic competence, social background and vocation, as well as his age and the groups he belongs to or identifies with. Because all of these factors influence how the receiver takes in and understands a message, they are decisive to how we shall formulate the text.

To begin with, we shall need to gather and sort our material, as well as plan and outline our presentation. We need to choose the type-face, graphical form, and medium. It may be possible to use fixed writing patterns and established models.

When we have formulated the text, we shall need to process it and adapt it, so that it will suit our target group. We may have to rewrite the text as many as ten times before it is right. Although it may be true that even the most complicated texts can be presented in a comprehensible form, all writers need practice, practice, and still more practice. Liljestrand and Arwidson (1979) assert the following:

> Complicated texts are often defended on the grounds that their subject matter is complicated. In reality, however, the more difficult the subject is, the more one must attempt to express it in a comprehensible way. It is surely more reasonable to expect that someone who is writing for several people expend effort on the writing of his text, than that the various receivers be obliged, each on his own, to expend effort interpreting it! (p. 15)

Also Strömquist (1991)) maintains that everyone must practice writing to become good at it. Writing is a skill that we can learn. She says the following (in translation): "It is only by writing oneself that one can fully understand the complicated writing process; it is only by writing oneself that one discovers where the problem lies" (p. 35).

Texts may need to be augmented by the addition of pictures, for example, photographs or schematic diagrams. I often begin the work of writing by making a comprehensive picture, which sometimes develops into a short suite of pictures before I begin work on the text. Bergquist (1991) gives textbook authors five terse, vigorous instructions in the form of *commandments* (in translation):

- The first commandment: Don't write! Even if the author's first impulse is to start writing at once, it is essential to start writing at once, it is essential to begin with an outline.

- The second commandment: Use pictures! Get a picture to illustrate each section; wait with your text.

- The third commandment: Write captions for each picture! Each picture should have a relevant text, which may even have a heading.

- The fourth commandment: Talk to your editor! Together, the writer and the editor can expand a factual outline into a detailed outline for each layout. The outline contains room for both text and pictures.

- The fifth commandment: Write in a structured manner! The text should complement the pictures. Therefore, write in the space between the pictures. The editor provides the author with exact data about the number of strokes each line of text may fill.

The actual process of designing and creating integrated verbo-visual information is called *infography*. When text, picture, and graphic form are integrated into a fully delimited, structure surface (a functioning whole), the result is a graphical information entity, usually known as information graphics, that can be interwoven with texts and pictures in a information layout.

Quality of Language

There are several different subheadings under the general heading *quality of language*, among them, phonology, morphology, syntax, style, pragmatics, and infology.

- Phonology is the study of phonemes, i.e., the smallest units of semantic differentiation found in spoken language, and combinations of these units. The smallest written unit that fills a semantically differentiating function is called a grapheme.

- Morphology, the study of form or structure, deals with how words are formed and inflected.

- Syntax is the study of the rules for combining words into grammatical phrases, clauses, sentences, and paragraphs.

- Style is the way of expressing thought in writing or speaking by selecting and arranging words for clarity, effectiveness, and ease of reading.

- Pragmatics is, in linguistics, the study of the causal and other relations between words and how we connect words to express ourselves correctly.

- Infology is the study of how verbo-visual information is presented and read.

The way in which good quality of language is defined is, to some extent, dependent upon the purpose of the text. Technical writers, for example, are more consciously concentrated on getting results than other writers. Because technical language must be capable of effectively conveying as much information as possible to a certain group of readers, it is characterized in its ideal form by brevity, clarity, and precision (see the section on Technology).

According to Melin (1992), comprehensibility in a text is largely dependent upon perspective, abstraction, context, complexity, and redundancy. As it is, these qualities are themselves difficult to describe; small wonder, then, that the

comprehensibility of text defies assessment.

In an experiment, Kirkman (1992) allowed a group of people to rate six different versions of four technical and scientific texts. In terms of content, the texts were equal to each other, but they varied in their style of language. All told, some three thousand people took part in the experiment. In the case of all four texts, the test group rated the versions that were written in an active, direct, and personal style as being the most easy to read and understand. Contrarily, the versions written in a passive, indirect, and neutral style, with complicated sentence structure, were judged by the test group as being the most difficult to read and understand.

To describe the properties of text, the linguist works with advanced text analysis. However, it is relatively easy to describe a text's readability by using a readability index, a character index, and a nominal quotient.

The premises on which the readability and character indexes are based is that long words and sentences make a text difficult to read. The readability index is the sum of two calculations: the percentage proportion of long words (consisting of--depending on the language in question--the number of letters or syllables in a given word), and the average number of words per sentence. The readability index, while usually corresponding rather well both to people's subjective experience of a text's readability and to their results in comprehension tests, has received strong criticism because varied sentence length actually contributes to ease of reading.

The character index can be looked on as a visualization of the readability index. Each sentence is analyzed and noted on a chart depicting a system of coordinates, in which the y axis represents the number of long words and the x axis the number of words per second. Thus, by graphically providing more than a single mean, the character index offers more thorough information about a text than the readability index does.

The nominal quotient gives the total number of nouns, prepositions, and participles divided by the total number of pronouns, verbs, and adverbs. A good information text has a quotient of slightly more than 1.0. Text with a lower nominal quotient seems *chatty*, whereas text with a higher nominal quotient is cumbersome.

Research into readability has been directed towards finding the characteristics that make texts easy or difficult to understand. Gunnarsson (1982) points out that the psychological equivalent to *readability* is merely superficial understanding. Therefore, she prefers to use comprehensibility as the term for characteristics that are related to deeper, specific text understanding. Gunnarsson's theory of comprehensibility is based partly on the correlation between the level of understanding and the level of the text, and partly on the premise that what is read influences the reading process.

It is also possible to calculate the readability of pictures (Pettersson, 1989) by using the picture-readability index, which takes into account a picture's functional properties and expresses how easy or difficult the picture is to read. A picture that we are unable to understand cannot communicate any factual information. The easier it is to read a picture, the better it can convey information.

In the USA, there is an increasing incidence of lawsuits being brought against manufacturers. These suits claim damages as a result of accidents occurring or products breaking because of poor quality in the language of instruction manuals (Helyar, 1992). The courts are demanding that technical manuals, brochures, information sheets, labels, etc., be written in comprehensible language, and that descriptions and instructions be readable and legible. Everywhere, plaintiffs' counsels are searching

frenetically for sections of text and parts of pictures that might be interpreted in conflicting ways. If a manufacturer's technical documentation is difficult to understand, he can lose a lawsuit.

The Message

The message is the link between the sender and the receiver. The sender designs the message and sends it off. The receiver receives it, and tries to understand it.

Teleman (1991) points out that the systems of rules that govern spoken and written language are similar in many ways. Originally, writing was a way of depicting speech, but the two coded systems later went their separate ways. The most tangible feature of the rules for written language is their standardization. In most western countries, the written language is comprehensible throughout the country and does not reflect differences in dialect.

An essential difference between the spoken and the written message is the time available for transmitting them. The production of speech must take place in the here and now; the speaker and his listener communicate in real time. On the other hand, the writer and his reader can take all the time they need.

In the written message, legibility, readability, and reading value are vitally important to the message's comprehensibility.

Legibility

The graphical message's legibility is determined by the technical design of the text and the picture, i.e., their clarity. Legibility can be measured rather objectively, and its quality is assessable whether we understand its content or not. As far as the text is concerned, we should avoid unusual type-face, as well as type-face that is too small or too large.

We read each word in a text as a *picture*, not letter by letter. In a book it might be sufficient to set the type between nine and twelve points, although on a display screen, the text should be at least three to five times as large. The text on a poster meant to be read from some distance may need to be ten times greater in size.

Legibility in the written word is comparable to audibility in the spoken word.

Readability

The readability of the message involves the reader's ability to understand its text and pictures (compare the earlier section on the readability and character indexes and the nominal quotient). Readability is determined by the content and its presentation, and depends upon the degree to which it is adapted to the receiver's capacity to understand it. The writer and the picture-maker need to take into account the reader's knowledge, interests, and needs in order to compile, sort, and structure the material. This is also true with regard to the formulation of texts and pictures.

Readability in the written word is comparable to distinctness in the spoken word.

Reading value

The message's reading value is the receiver's subjective evaluation of the content of the text and pictures. What is interesting to one person can be deemed dull by another. We must therefore adapt text as well as pictures to be palatable to any given target group.

Reading value in the written word is comparable to listening value in the spoken word.

Pictures

When producing informative material, the sender always has a reason for adapting his message so that the receiver understands it. Pettersson (1989)

reports on a number of experiments in which altogether 4,350 people described how they interpreted the contents of different pictures. The experiments clearly showed that:

- How a picture is understood is a relative thing. Different people understand and describe the same picture in different ways.
- Even simple pictures need plain captions in order for the contents and presentation to be conveyable in verbal form.
- Pictures of abstract subjects are understood in considerably more varied ways than pictures with concrete subjects.
- Abstract subjects are described in concrete terms.
- The same intended theme or subject can be expressed through many different pictures.
- Texts and pictures are completely different *languages* that complement each other.
- The possibilities for combining texts and pictures are virtually unlimited.
- There is not likely to be just one but several equally good options available for achieving satisfactory communication.
- Pictures that will be used for information purposes should always be given captions that confirm the interpretation that is most relevant in the context.
- The interplay between text, picture, and graphic form needs to be studied thoroughly before optimal combinations can be found.
- We are able to differentiate between *immediate* and *analytical* understanding of pictures.
- We create a *pre-understanding* of how a picture should be interpreted based on the context in which the picture is shown.

Media

As a rule, the content of films and television programs is presented in a preordained fashion, which tends to encourage relative passivity in viewers. The same is true of prepared oral presentations.

The reader of a book digests textual and pictorial information at his own pace. If the information presented in the book has a structured surface, i.e., one in which the information is integrated into a single context, the reader can focus his attention relatively freely. The experience is akin to the way we take in information in real-life situations.

Interactive video programs make it possible to combine sound and moving pictures; thus, they can arouse considerable activity and commitment in the user. Because an interactive video program can stimulate the user to perform at a high cognitive level, it has the potential to function well, both as a conveyor of information and as a teaching aid.

Credibility and Esthetics

For a message to be effective, it needs not only to be credible but to merit credibility as well. First, its content must be correct and the quality of its text and pictures beyond reproach. Convincing arguments, proper references, and relevant examples are other requirements, as is presentation of the message in concrete--as opposed to abstract--terms. Credibility can also be influenced with the help of typography and layout.

The National Swedish Psychological

Defence Planning Committee has carried out comprehensive studies of various media's credibility (Arvidson, 1981; Törnqvist, 1974). Receivers of information evaluate credibility according to how they perceive the straightforwardness, the factual content, and the comprehensibility of the message.

Thus far in these tests, ether media have always won the greatest credibility. At the end of the 60s, television was considered superior in credibility, although by the beginning of the 70s, radio was considered most credible. During the 80s, radio and television were felt to be equal in credibility; fully 80% of those questioned were in accord with this. However, it does not seem as though people in Sweden trust the information found in newspapers. In the autumn of 1981, slightly more than 10% judged the morning papers to be *most credible*, while only 1-2% made that assessment of the evening papers' information.

It is primarily the younger generation who have the most faith in television. The older we are, the more credible we find the morning papers. Furthermore, trust in the morning papers is greater the higher our level of education is.

Material with a (sufficiently) pleasing esthetic form has greater potential for conveying a particular message than does unaesthetic material (Pettersson, 1989). The sender's choice of graphical form will generate either positive or negative expectations in the receiver, while the choice of typography and layout can often give the reader a pre-understanding of the message's content.

In other words, it is important that a visual message exhibit good legibility, or, it it is a spoken message, distinctness. The message may be esthetically pleasing, but its content is more important than its form.

Terminology

There are as many different varieties of shop-talk, i.e., trade jargon, as there are vocational fields. In technical reports, for example, one finds far more detail and uncommon wording than in the language at large.

Terminology, the study of terms, encompasses terms, concepts, idioms, definitions, references, conceptual systems, and semantics. A term is a word or expression for a particular concept found in a given field of work, in which it has a specific and carefully determined meaning. A concept is an idea of something formed by mentally combining all its characteristics or particulars. An idiom is a fixed expression whose meaning is not discernible from the definitions of the individual words of which the expression is made up. A definition is a description of a concept rendered in words. A referent is an object, abstract or concrete, for which a name or designation stands. A conceptual system, or a conceptual hierarchy, is a systematic description of the relations between the various concepts in a particular area of thought. Semantics is the study of the meaning of verbal expressions and the implications of combinations of words.

The subjects lexicology and lexicography also belong to this area. Lexicology is the science that deals with the structure of vocabulary. Lexicography is both the study of how dictionaries are compiled and the actual process of compiling and writing them.

The Reading Process

Both the reading and the listening processes require decoding of symbols, pre-understanding of words, phrases, and pictures, and, finally, comprehension of the content of the information. Furthermore, as we mentioned before, the legibility, readability, and reading value of the written message influence the reading process. In the case of the spoken message, the message's audibility, distinctness, and listening value influence the hearing process.

As far as the receiver of the message

is concerned, the following are some of the factors that greatly influence his intake of information:

- Earlier experiences and observations.
- Perception.
- Learning.
- Memory.
- The reading objective.
- The reading procedure.
- Pre-understanding.

Memory

Reading texts and pictures, and actively listening, are dependent on our short-term memory, as is all mental activity. Only a certain limited amount of information can be contained in the short-term memory at any time. New information crowds out information that is older than about a second, and the older information easily disappears if we are not prepared to store it in our long-term memory. If we repeat the information a few times, we increase our chances of remembering it. Long, complex words in a text are not immediately apparent to us, our short-term memory becomes overloaded with long chains of words that cannot be directly put into a meaningful context.

The Reason for Taking in the Information

Gunnarsson (1982) discusses five different categories of reading objectives. What differentiates them is the kind of stored knowledge that must be invoked in order for understanding to take place. Of course these categories are not sharply delimited, but overlap.

- In memorization of the textual surface, the objective is to create a visual memory of the text's surface.
- In registration of the text's content as such, the objective is to understand the written message's structural and conventional importance.
- In comprehension of the sender's description of reality, the objective is to understand what the sender means by the text.
- In integration of the text into one's perception of one's own surroundings, the objective is to integrate the text into one's own earlier experiences and observations.
- In direct, action-related comprehension, the objective is to know how one should behave in different situations, based on what the text says.

The first objective involves reading in order to recognize each word and memorize the text surface, while the second requires us to read and understand the words in the text. With objectives three to five, reading is directed towards individual sentences, parts, and the whole of the text, and other proficiencies and ideas are brought to bear on the material. Objective three, for example, obliges the reader to interpret the text in terms of the sender's situation. Objectives four and five require that he interpret the text in terms of his own surroundings and world view.

Möijer (1987) states that we read in different ways depending on what purpose our reading serves. We read intensively, every word and line, when our purpose demands it. We skim if we only wish to quickly get some idea of the material. We read to orient ourselves if we want to know where in a text some particular information is found. We read to inform ourselves when we need certain limited

information. In each of these cases, we leave out anything that does not directly satisfy the purpose of our reading.

Different reading objectives (Gunnarsson, 1982) or purposes (Möijer, 1987) attached to reading give rise, therefore, to different reading purposes. These purposes differ in terms of the level of text on which the reader focuses, and in terms of how the material is processed.

The Reading Procedure

According to Gunnarsson (1982), the reading procedure is of great importance to the reader's capacity for understanding a text. In *normal reading*, we direct our attention towards how we shall interpret the meaning of a sentence. Studying the syntax becomes subordinate to orienting our thoughts amid the semantic and pragmatic relations that form the text's warp and woof. When we read long continuous texts, we process separate sentences with an eye to their integration into the material's entirety. This takes place gradually, with the text that we have already read providing the framework. Text comprehension is a constructive process, in which the reader builds up his perception of the whole by integrating the text with his own experiences.

Pre-Understanding

An important step in the reading process is pre-understanding (Pettersson, 1989). As I mentioned before, the graphical form of a text creates expectations in the reader regarding its content. We expect certain types of documents to look a particular way; contrarily, when we see a document of a certain type we expect a particular type of text and pictures to accompany it. Thus, it is in the light of these expectations that we activate the cognitive processes needed to interpret the message.

The reader develops his own methods for predicting what a text will be about. Introductions, abstracts, tables of contents, summaries, illustrations, and tables all have important functions to fill.

Television producers are usually good at showing what their programs are about. In countries with a great many television channels, it has been noted that viewers switch rapidly between different channels until they find program that awakes their interest. Sometimes a viewer will make up his mind within the space of a couple of seconds (Matsushita, 1988).

Language that is rich in similes and metaphors makes it easier for the reader to paint his own inner pictures. A well constructed text with clear, distinct arrangement and lucid paragraph disposition, organized under well formulated headings and captions, affords the best reading experience.

Costs

When a great many people are required to read and understand information during working hours, the cost incurred is great. It can be expensive to produce information, but it costs even more to store, find, and use it. The greater number of individuals who must partake of certain information, the greater the cost will be. The cost of reading is determined by the type of documents that will be read, as well as by the groups that will read them. Thus, presenting information in a suitable way offers great opportunities for saving money. In the handbook called "Plain Talk from the Cabinet Office," that is provided for use by members of that body, Ehrenberg-Sundin (1982) states that judicious planning of texts can save millions. She writes as follows (in translation):

> It is expensive to read texts! The cost of reading is often many times greater than the cost of writing and printing the material. Besides, if readers do not understand the text, or if they interpret it incorrectly, it becomes VERY expensive! This problem can be solved by planning text better. It should have a purpose and the selection of its content must

> agree with that purpose. Thus, we can avoid the greatest reading expenses. If we help the reader further by writing comprehensible language and giving the text a sensible presentation as well as an arrangement that is logical to him, we shall have saved still more time and money.

The cost of reading and understanding text is in most cases many times greater than the cost of producing it. Ehrenberg-Sundin (1982) offers an estimate:

> For a report that has cost SEK 80,000 to print and just as much to write (four months' salary for a committee secretary), the cost of reading it will be SEK 1,600,000 if 1,000 persons spend eight working hours each (at SEK 200 per hour) to read and understand it.
> The greater the number of people who are meant to read a text, the greater the incentive is to expend extra effort on making it easy to read!

In private companies, the cost per hour is usually reckoned at SEK 400 or more, instead of SEK 200. (Since 1982 these costs have increased considerably due to inflation; however, the rations remain the same.) Thus, in industry, savings in this area can be still greater than they might be in the public sector.

Melin (1986), and others refer to a cost estimate that was carried out at the Swedish Telecommunications Administration (Televerket). The total cost of a 20-page technical report was estimated in SEK per page as follows:

Writing	5.60
Printing	1.40
Storage	25.00
Reading	225.00

In other words, the cost of reading the report was many times greater than all the other costs put together. The author's work on the text represented only two percent of the total cost.

Writing Advice

Against the background of the previous discussions (regarding comprehensibility, communication, experiences, the writing process, quality of language, message clarity, credibility and esthetics, terminology, the reading process, and costs), it is possible to give some concrete advice, or rules of thumb, on good writing strategy as the key to good comprehensibility. These rules of thumb, besides being written so that any writer can easily follow them, are divided into the following sections: Analysis, preparation, writing, using pictures, and doing the final touching-up. In some places, references to relevant literature are given, if you want to penetrate the material more deeply.

Analysis

- Investigate who will read your text.
- What characteristics do the readers have?
- What is the purpose of your message? Do you want to inform, give instructions, or influence your readers?
- Are the readers positively or negatively disposed to your message? What are their expectations?
- How will you convey your message to the readers? What medium or media will you use?
- What financial conditions or limitations apply to your work?
- What external factors can influence how the readers will interpret your message?

Preparation

- When you create a message, always proceed from what you yourself know about the readers. What is the readers' level of knowledge?
- Draw up a preliminary plan for your writing. Allot sufficient time for it.
- Gather material, for example, by reading, interviewing people, making observations, and performing experiments.
- Collect the pictorial material (see Using Pictures below).
- Sort out the material that will be included with your text. Proceed from what you know about the readers' potential for understanding it. Focus on the most important aspects.
- Structure your material. Make an outline of your subject; it can later be refined and given more detail. A technical report should have a title, a table of contents, an abstract or summary, an introduction, description, an analysis, a conclusion (including your own viewpoints), and a list of sources or references. Avoid footnotes and appendices, as they are seldom read.
- There are different types of outlines, for example, narrative and logical outlines. Do not switch between different types in the same document.
- Write an interesting title and, if you like, a subtitle.
- Choose a graphical form that suits the material. It will make things easier for the readers if information of the same kind is presented in a similar way. A well-thought-out graphical form contributes to the readers' understanding.

Writing text

General

- Let your writing be simple, clear, and concise. Express yourself in specific rather than unspecific terms.
- Use a style that is natural for you. Avoid both colloquial language and excessively formal constructions.
- Analyze, argue, describe, compare, refer, make associations, spin a tale, all according to what you think is needed.
- Try not to insinuate subjective values into your text. If is is your own opinion you are expressing, make this plain.
- Avoid writing in a style that is to laconic or sterile, but don't allow yourself to become *chatty*. Sentences that are too dense, i.e., sentences in which too many ideas are concentrated, will make your text tedious reading.
- Use aids, such as dictionaries and encyclopedias. For a guide to English writing, see the Economist (1991) "Style Guide," "Good Style" by Kirkman (1992), and "The Elements of Style" by Strunk and White (1979).

Words

- Avoid long, polysyllabic, complicated words.
- Avoid buzz-words, slang, and

expert jargon.

- Use defined, established terminology. If you are obliged to use abbreviations, define them in full the first time they appear in text.

Sentences

- Try to have your sentences say one thing at a time, don't cram them with ideas. In general, try to vary the length of your sentences to increase reading ease, but avoid sentences that are too short or too long.

- Avoid complicated word order and subordinated clauses. Be particularly careful in your placement of modifiers. Avoid the passive voice ("The B process is affected by A"); write active sentences ("A affects the B process"). Use verbs instead of nouns and gerunds.

Paragraphs

- Let every paragraph encompass a single unit of content. Avoid long, convoluted paragraphs that meander in all directions.

- Link sentences and paragraphs with conjunctions and/or adverbs (and, nevertheless, moreover, because, but, however, therefore, although, because, since, or even, thus), making sure at the same time that the things linked together bear a logical relation to each other. In the sentence "the project was terminated due to calculated project costs and more profitable use of resources, the phrase terminated due to" implies that whatever is to follow will have had a negative effect on the project's progress. However, "calculated project costs" and "more profitable use of resources," besides being neutral rather than negative in effect, have no logical relation to each other, nor do they tell why the project was terminated. The sentence should read: "The project was terminated due in part to project costs being calculated as excessive, and in part to the necessity of putting resources to more profitable use."

The Entire Piece

- There should be a *red thread* running through the text. Try to find a unifying principle. Clearly show what it is that you want to express.

- If the subject is on a high plane of abstraction, use concrete examples that illustrate the principles.

- Use similes and metaphors. They make it possible for readers to paint an inner picture.

- If the text shows a high degree of specification and examines a great many separate details, you should summarize every now and then, and draw conclusions.

- Sometimes you may find it necessary to write your foreword, introduction, and summary after the body of the piece is written.

- List your references clearly.

Using Pictures

- Use pictures to make it easy for the reader to understand your message.

- Any pictures you use should be clear and easily read. Pictures

should always have captions.

- Pictures and text must interact to produce a seamless unity.
- Place texts and pictures that belong together as close to each other as possible.
- Do not change the content of a picture by using different forms of computer manipulation. This practice is often unlawful, and always unethical.
- Never try to pass off unauthentic pictures as being true depictions of reality.
- The source of any borrowed pictures should be identified.
- For a guide to visual language see "Visuals for Information. Research and Practice" (Pettersson, 1989).

Doing the Touching-Up

- Let your text *rest* for a week or so, then read it from the reader's point of view. Make the necessary amendments.
- Check that the finished text corresponds to the text as you had planned it.
- Edit your text! Polish it. Trim away any unnecessary bulk. Iron out inconsistencies. Simplify the language. Clean up the punctuation. Every sentence should be easy to read!
- Check style and grammar. Discrepancies in grammar and style hinder the reader's progress and make the writer less credible in his eyes.
- Check spelling and word division at the end of lines. In some cases, functions in your word processing program can help you with this.
- Check your references and other formal aspects of your paper.
- Refine the typography and layout so that the headings, tables, and pictures are presented in a lucid, esthetically pleasing graphical form. Make optimal use of the possibilities that typography offers.

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C.A.I. AS A MEANS FOR EDUCATIONAL JUSTICE IN PRIMARY SCHOOLS: A GREEK EXPERIENCE

by
Nicos Raptis

Inequalities in Education and the Use of Computers

Inequalities in the Capacity of Access to Computers

The social implications of the use of modern technology, and particularly computers, as a means of minimizing the inequalities in education is inadequately researched ground (Langouet, 1982; Lee, 1989).

Literature has always been more concerned with the established fact of the unequal distribution of computers (CE.R.I., 1986; Dubois & Schubert, 1986).

According to Dubois and Schubert (1986), there are 1.3 times more computers in the prosperous areas in the USA than in the less prosperous areas.

Authors like Lepper (1986) had written that the inequalities we notice in the capability of access to computer hardware as well as in the quality of the software being used, may potentially have an aggravating effect on the factors already generating inequalities in education and, thus, "make the rich richer and the poor poorer" (p. 14).

Other authors like Martin and Hearne (1989) report these inequalities are "to take advantage of the more gifted children" even regarding the duration of time spent on school computers, where available.

Inequalities in the capacity of access to computers can also be noticed between different countries.

Despite the lack of adequate data, it seems that the computers used in education in the developing countries are not only much fewer, but also the capability of access to them is even more unequal than in the developed countries (Abass, 1981; Bustamante, 1987; Marinho, 1987).

Criteria for the Determination of Disadvantageous Target Groups Regarding the Study of The Effect of Computer-Assisted Instruction (C.A.I.) on the Inequalities in Education

Physical and Emotional Criteria

In research carried out into the effects of CAI on the inequalities in education, several peer groups have been looked into by the standard judgement of physical and emotional disadvantages.

In a meta-analysis of twenty-six studies dealing with the use of CAI on children with special needs, Schmidt, Weinstein, Niemic, & Walberg (1985/86), showed that the use of CAI is, in general, positively connected with the improvement in school achievement of children with special needs.

Social Criteria

Regarding the studies dealing with the effects of CAI on children of different social or educational backgrounds, those of Suppes and Morningstar (1972) and Osin (1981) showed that CAI mostly favours less privileged children.

Osin (1981) reports that, owing to CAI, children performance in Arithmetic improved at rates ranging from 55% to 193%.

The argument that CAI mostly favours children whose school achievements are below standard, has been buttressed also in the meta-analysis of Jamison, Suppes, & Wells (1974), Kulik, Bangert, & Williams (1983), Bancert-Drowns, Kulik, & Kulik (1985) and in studies such as those of Burmester and Lawson reported by Langouet (1982) and Charp (1977).

CAI and the Inequalities in Education: The 'Optimistic' and the 'Pessimistic' Scenarios

On the basis of the observations of authors such as Langouet (1982) and Stonier (1981), we could makeup two scenarios, an *optimistic* one and a *pessimistic* one, as far as the social implications of CAI are concerned.

The Optimistic Scenario

Stonier (1981) claims that:

> As the state takes on further responsibilities in education, and as education evolves into the number one industry of post-industrial economies, all homes will be provided with advanced electronic education/information systems. This will cause the gaps between various social groups to narrow substantially, perhaps disappear. (p. 854)

Reckoning that the trend toward cheaper, more powerful, and user-friendly computers will continue, Stonier connects the invariable increasing propagation of computers with an increasing equalizing outcome in education (Figure 1).

The Pessimistic Scenario

In a study of his with which the effects of educational technology on inequalities in education, as these appear when using different media is examined, Langouet (1982) reports: "We have observed that, on the one hand, *weaker* groups did not do as well as the *stronger* groups and, on the other hand, the gap kept going wilder as the teacher process became more *complicated*" (p. 16).

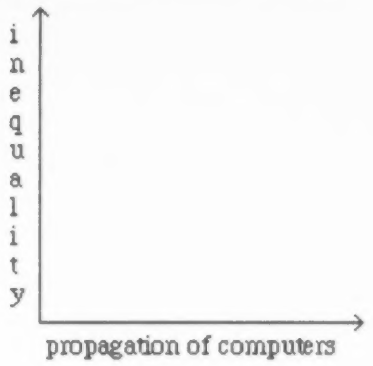

Figure 1.

Here Langouet formulates a connection between the complexity of educational process and the equalizing outcome to teaching, making up a pessimistic scenario regarding the equalizing effect of such methods as CAI on the inequalities in education.

The Question. The Hypotheses

The question we looked into during the academic year 1988/1989 was whether CAI would lessen or augment the inequalities in education as these appear among children of less privileged backgrounds. The hypotheses formulated were:

Hypothesis 1: CAI will improve the school achievement of children of a favoured background (F).

Hypothesis 2: CAI will improve the school achievement of children of a favoured background (f).

Hypothesis 3: CAI will improve the performance of children of a less privileged background more than that of the children of a privileged background.

The Experiment

In order to substantiate any one of

the hypotheses, we taught, by way of experiment, the lesson of "Researching the Natural World," which deals with the natural sciences to 116 children going to the fifth level of Greek primary school (aged from 9;6 to 10;6). The subjects of the experimental groups went to two different public schools of Thessaloniki, one of which was in a privileged area (in the center of the city), and the other one in a less privileged area (Ampelokipi).

The subjects had eight (8) CAI sessions throughout the academic year. In each session, one particular unit was taught, the way it is determined by the most rigorous, obligatory national syllabus which is found in the official coursebook.

The units taught by CAI were carefully selected in order that: (a) They were almost equally allocated throughout the academic year, and (b) they were not the easiest units in the syllabus.

In each school the subjects were divided into two groups of 24 up to 34 pupils. In each school the subjects of the first group had CAI sessions (Group A), while the subjects of the other group (Group B) were taught all the units in the traditional "talk and chalk" way (TW).

Throughout the CAI session, which lasted for 45 minutes, the subjects came into contact only with the computer and the other members of their own CAI-user's sub-group (which consisted of 2 up to 4 subjects). The subjects had no previous experience of using a computer in class, and neither school was equipped with computers before the experiment.

The computers used in the experiment were Apple IIc, while the educational software were specially developed for the experiment, in the Applesoft Basic language. The behaviouristic-type programmes involved data display, questions, simulations, and games and made use of pictures and animation. The educational software design of the behavioristic type was selected for three reasons:

1. It satisfied the need for the simple and very easy use of the computer by the subjects.

Indeed, the subjects only needed to perform nine simple and similar to each other operations in order to make use of the software. The operations involved, for example, pressing any key (so that the subject could see the *next page* in some program of data display), pressing keys *1*, *2*, or *3*, and then, possibly, the *Return* key (so that the subject could answer a multiple-choice question).

It is worth mentioning that the subjects of the CAI groups only needed one 45 minute introductory session of computer familiarization before they could continue.

2. It satisfied the need for specified time controlled CAI process, since each unit had to be thoroughly taught within 45 minutes.

3. It had been established that the major control of CAI process by the computer which is typical of the behavioristic type educational software, favours pupils of lower school achievement (Dépover, 1987; Lee, 1989).

The use of the Peters and Johnson evaluation scale showed that the educational software used in all eight sessions were academically equal.

The subject's achievement was assessed by using five tests which were made up to meet the requirements of the experiment and referred to five chapters of the coursebook (Thermal and Light Phenomena, Mechanical Phenomena, Electric and Magnetic Phenomena, Biological Phenomena-Living Organisms, Mechanical Phenomena in Liquids).

The t-test was used in order to look

into the effect of CAI on the subjects' school achievement.

The Results

The results indicated that the subjects at the less privileged (p) school profited more by CAI. The subjects' performances on the units they were taught by CAI was 51.17% higher at the p-school while at the privileged (P) school it remained the same (fell by 0.77%).

Regarding the subjects at the school in the less-privileged area, Group B (who did not have any CAI sessions) did better than Group A (who had CAI sessions), as far as the units taught in the traditional way (TW) are concerned. However, when it comes to the units which were taught using CAI, it was Group A who demonstrated better results. This conduct is uniform in all five chapters (Figure 2).

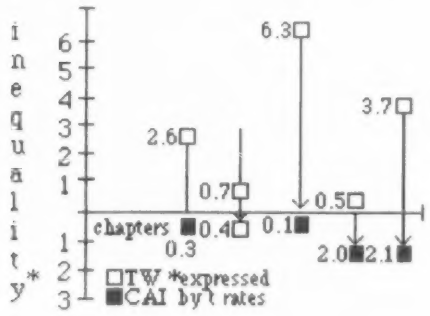

Figure 2.

Likewise, we get corresponding results when comparing the two groups who had CAI sessions at both schools (P and p). In the units taught under CAI conditions, the *Inequality Index*, as it is expressed by the rate of the t test, falls dramatically and in a uniform way, in relation to the rates it has in the units taught to both groups in the traditional way (Figure 3).

Contrary to what seems to be the case of the p-school, CAI does not seem to influence the subject's performance at the privileged P-school.

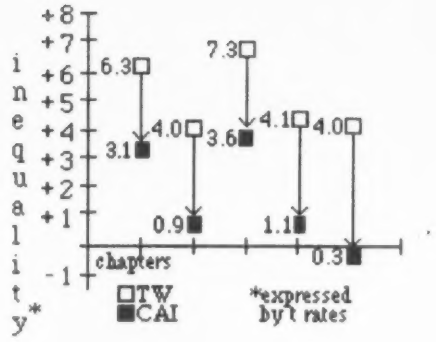

Figure 3

At this school, the performance of the Group who had CAI sessions does not present significant differentiations, in comparison to that of the Group who did not have CAI sessions, either in the units taught by computer, or in the units taught in the traditional way. The only exception is the chapters Thermal and Light Phenomena and Electric and Magnetic Phenomena, where, as it seems, the use of CAI had a negative effect on the subjects' achievements (Figure 4).

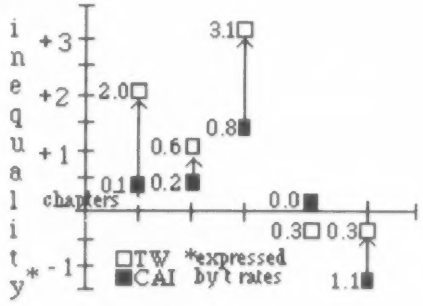

Figure 4

Conclusion/Discussion

The results of the study indicate that children of less favoured backgrounds profit with by the *standard* CAI of natural sciences more than those children of favoured backgrounds. This appears to be a uniform result and it is not influenced by the content of the lesson which is taught with the aid of a computer.

In an attempt to interpret these findings, we believe that:

Children of less-favoured backgrounds are more easily motivated into taking up something new, which will probably act as a spur to creative work.

A less prosperous/privileged area attracts less experienced teachers, with little interest in their work; teachers who will probably want to live and work there on a less permanent basis; less efficient teachers who tend to avoid using any teaching aids available (Plowden Report, 1966). This situation renders even the relatively *poor* educational software particularly effective in the less privileged areas.

Naturally, much more research needs to be carried out:

Regarding the role of educational software design in the lessening or augmentation of inequalities in education.

Regarding the effect of the computer propagation rates on the increase or not of the interest that children take in computers:

Does the similarity of the computer "to the archetype and symbol of mass culture" (CERI, 1986, p. 111) television, favour the development of children's interest in it or not?

Does the non-existence of computers in the surrounding (school, home, recreation area) of many children in large areas of Greece and other *semi-peripheral* countries, favour or not the development of the children's interest in using computers?

Could we regard the *interest in computers* and the level of *familiarity* with it as opposing or collaborating elements?

The questions above are of particular importance in countries where the bleak situation of the economy does not allow for investments in educational software, while, at the same time, the transfer of software which is in the English and French languages is hindered because of lingual, educational, and political reasons.

A lot more research still needs to be carried out before we acquire reliable data on whether the use of computers presented in this study is cost-effective in applications such as the use of CAI in small rural schools, or an increase in the number of pupils per class so that the need for new school buildings is minimized and the afternoon and evening *shifts* in certain schools are abolished.

Summary

After an overview of the literature concerning the effect of CAI on educational inequalities, here we presented a research that shows the effectiveness of a low-cost, behaviorist-designed CAI as a means for educational justice in primary Greek education.

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THE ROLE OF IMAGERY IN LEARNING BIOLOGY SCIENCE THROUGH TELEVISION

by
Ora Silverstein and Pinchas Tamir

Theoretical Background

The Information Age and the Role of Pictorial Representation

Telecommunication is becoming a main source of stimuli, perception, and knowledge. It has been stated that visual communication is taking over verbal communication and that pictures have become the main method of transmitting information (Gombrich, 1972). It has also been declared that television is the main source of knowledge in our civilization (Metallinos, 1985; Pettersson, 1989). Television enables viewers to perceive living creatures and natural phenomena in the macro and microcosmos. Therefore, it is important in acquiring a knowledge of the natural sciences outside the scope of the school. Although there has been progress in research on learning through television, the learning of scientific concepts from television has hardly been studied. Our research (Silverstein & Tamir, 1991) is concerned with this subject and studies the perception of symbol systems that represent concepts in biology. It compares two different television symbol systems: Story animation and documentary, representing the same biological concepts.

According to Howard (1987), Bruner identifies certain stages in child development starting from visual experiences and progressing to abstract thinking. The development starts from the *enactive* stage in which the child *sees* the world by means of action. At the end of the first year he/she proceeds to the *iconic* stage, in which comprehension of the world is through pictures, and the child acquires a *mental image* of his concepts. From the age of seven the *symbolic* stage begins, in which the child sees the world through its representation by symbols.

Norman (1980) states that environmental stimuli are the main source of human perception. He suggests a model of the human cognitive system which includes sensual perception, memory processes, motivation, thinking, emotions, and motor functioning. He calls these complex cognitive processes information processing. Memory processes are important in the complex of cognition and modern theories explain the forming of memory, the ability of recognition, and the dynamics of the process of conceptualization. Experiments have proved that memory recording begins with *sensual memory*. The impressions of sensations accumulated in the sensual memory are called *images*. Images pass into the short term memory and later become accumulated into the long term memory. The representation of an object or creature, say a certain animal, plant, or microorganism, is a result of a sensory act comprising the perception of sight, smell, voice, and its name (word). Therefore, the stimulus data from our environment come from objects and living things and also from symbol systems. Gregory (1978) studied the recording of visual impressions. According to him, the eyes supply the brain with information transformed into a code of nerve activity. Gregory's and others' research allow for the existence of nervous centers in which impressions are recorded and stored in the brain. The symbol systems perceived by the senses are called codes. Since television experience involves the senses of both sight and hearing, the impressions of television are transferred to memory as images.

Learning, Conceptualization, and Symbol Systems

Today's literature, concerned with the psychology of learning, points out that intelligent learning is a formation of concept structures communicated and manipulated by means of symbols.

According to Olson (1974), a symbol is any sign, event, or phenomenon that can be used in a referential way and which can potentially be organized into systems. Symbol systems are discussed in philosophy, cognitive psychology, and the theory of art and semiotics. There are different visual symbol systems. An icon is a picture similar to its object; painted pictures or photographs are icons. A cartoon is a picture that gives information about the object, person, or situation represented in an exaggerated way. The still cartoon and animation that gives the sense of life and motion are symbol systems that imitate their references using exaggeration for emphasis in contrast to icons that resemble their references more realistically. Icons are the type of pictures shown in a documentary movie.

From Vision Through Perception to Conceptualization

In order to understand human cognition, it is best to consider two complementary sources. The first is perception as a neurobiological process connected to the function of the central nervous system, and the second is the influence of science and art on perception. The discussion of one of these without the other will give an incomplete picture. There is no argument about the recent findings (Gregory, 1978; etc.) from neurophysiological studies about the anatomy and function of the eye, retina, optic nerve, and brain vision. However, there is a controversy about the influence of both general and personal prior knowledge on perception and visual imagery which will be discussed here.

Perception and Imagery

Perception is explained as a process taking place in two stages. The first stage is sensation. In the second stage the stimuli become meaningful and then they develop into units of knowledge. Wartopsky (1976) states that: "The world perceived by the organism is a map or an image of its activities" (pp. 27-28). He explains that sight is not merely a result of the operation of the biological tool that developed by evolution--the human eye.

In his opinion the self creates a new different world--that is, a cognitive construction--and the representations created become models and theories in science and pictures in art. According to cognitive psychology, an image is a sketch of a sensation that is stored in the sensual memory and as such it is a mental representation of anything no longer available to the senses. A visual image in the brain is parallel to the optical image of an object produced by an optical system, for example, the image produced by a camera. As images are pictures of reality, the act of imagining is the manipulation of mental pictures as opposed to the manipulation of concrete objects.

Perceptionalism and Intentionalism

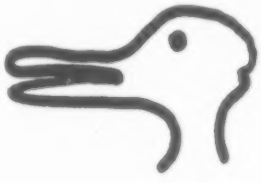
The perception of pictures is a response to basic forms according to the laws of Gestalt theory; the basic unit of understanding in visual thinking is the percept (Arnheim, 1974; Olson, 1974). How does the perception from pictures occur? Perceptionalism and intentionalism summarize the philosophical semiotic and psychological schools of thought on this subject.

Perceptionalism is an approach based on Gombrich (1960) and Gregory (1978); they say that the picture does not have its own meaning but the viewer creates for himself a unique meaning based on his prior observations, experience, and expectations.

Intentionalism (Goodman, 1976) is based on a semiotic approach which says that in any picture there is an inherent meaning and the viewer is meant to reveal it. The meaning of a picture is determined by the artist, and as such it has its own essence which does not depend on the individual viewer.

In Goodman's (1976) opinion, presentation of symbols in science and the arts is based on convention and is thus valid by a semiotic or social agreement. Goodman also distinguishes between a realistic representation and a representation that has a dissimilarity to reality. Our research deals with the perception of biological concepts in two symbol systems, realistic--the documentary code--and non-realistic--the story animation code. Plato, in his writings, demanded that a picture be similar to reality. In the communication systems that serve us today pictorial representations are either realistic or they represent reality.

Gombrich (1972) who is of the same opinion as Gregory, does not agree that there is an *innocent eye*. He explains that the perception in the brain of the image produced by the visual field is a function of both the pictorial representation and other aspects such as history, culture, and psychology. Most pictures do not represent simple objects but ideas that are *conceptual schemata* (abstract generalizations of an object or a group of objects) kept in people's brains. The assumption of this approach, also agreed by Goodman and Wartofsky, is that visual thinking is done by cognitive representation systems comprised of visual images. The same process works for other representation systems like linguistics and music. Reality and imagination relate to the way a person tends to represent the stimulus data to himself in his schemata. Blich (1989) adds that there are two groups in each audience. The first one relates to the pictorial as if it were the real world. The second group knows that this representation is not real. In our research this was evidenced by the differentiation between the groups with regard to animistic versus causal thinking. The theories of cognitive psychology about visual thinking and the empirical results of our research lead to the acceptance of Gombrich and Blich, and thus to the rejection of the existence of an *innocent eye*. A famous example, the well known picture of Jestrow, is given by Gombrich (1972):



What do you see in the picture? (a rabbit or a duck?)

There are two images merged into one and seeing the rabbit or duck depends on the viewer's ability to discern from the picture one of the two images.

From Percept to Concept

According to cognitive psychologist Howard (1987), the structures that are used to build perception are existing schema, images, and symbols. The schema is a sketch that represents the outstanding components of its reference. For example:

Schema of a face:

Howard states that the schema is associated with different stimuli and that its action is like a filter, it enables only part of the information to pass through. The image is more complicated than the schema. An image of a face is a detailed picture of someone that we remember very well. The symbol is an abstract way of referring to the particular image.

Howard (1987) asserts that reality is experienced after it has been filtered through the categories or the concepts.

According to Howard a category is a class into which stimuli are placed according to some similarities and a concept is a mental representation of a category.

Every stimulus can be placed in one of many different categories. A house can be a place to live, obstacle, burden, investment, or *home*. Ausubel, Novak, & Hanesian (1978) had used the example of a house to show that when someone refers to *house* he refers to his personal projection of it. Personal experiences cause the idiosyncratic character of the concept to be built. They claim that experience undergoes the procedures of selectivity, abstraction, and schematization to form the concept, and thus the concept is not a direct representation of sense data.

The Ongoing Change of Human Perception

McLuhan (1964) states that television has components that are analogous to comics and cartoons. In the cartoon there is an exaggeration of an aspect that causes dissimilarity to its object. Television images are unrefined, like those of the comics. In the three media, television, animated cartoons, and comics the viewer participates in a *fill-in* and *do-it-yourself* activity. McLuhan uses the concept television image and describes its characteristic as a raw image. According to McLuhan there has been a fundamental change in human perception and cognition caused by the communication media and in his opinion there is no one approach that fits this enormous change. There is still no unified theory that explains this phenomenon.

The Main Goal

The main purpose of the research was: To study the learning and natural-sciences by means of unguided viewing of television.

Methods

Study of Broadcast Content

Our study examined the learning of biology by means of unguided viewing of the medium of television using two different codes. The perception of the biological concepts in the two subjects: *The Cell* and *Birth* was represented in both story animation and documentary form. In the course of the study a content analysis of the dual-coded broadcasts was made. Broadcast content analysis was done before; Erdman (1991) did a formal analysis of the format and message of the teaching film. However, in the broadcast content analysis, instead of a shot-by-shot analysis of the visual and audio track that were used by Erdman, in our study broadcast scripts and videos in French, English, and Hebrew were used at different stages of the study. The scripts that were used provide a full documentation of the verbal audio track. Analysis of the broadcasts, preparation of the tools, the launching of the study, and analysis of the findings gave rise to a growing familiarity with two visual systems of symbols, each with its own unique advantages.

The Story Animation Code consists of strange and complex illustrations that are unusual and novel. These are artistic symbols representing the content of biological concepts that are usually represented in pictures or scientific symbols.

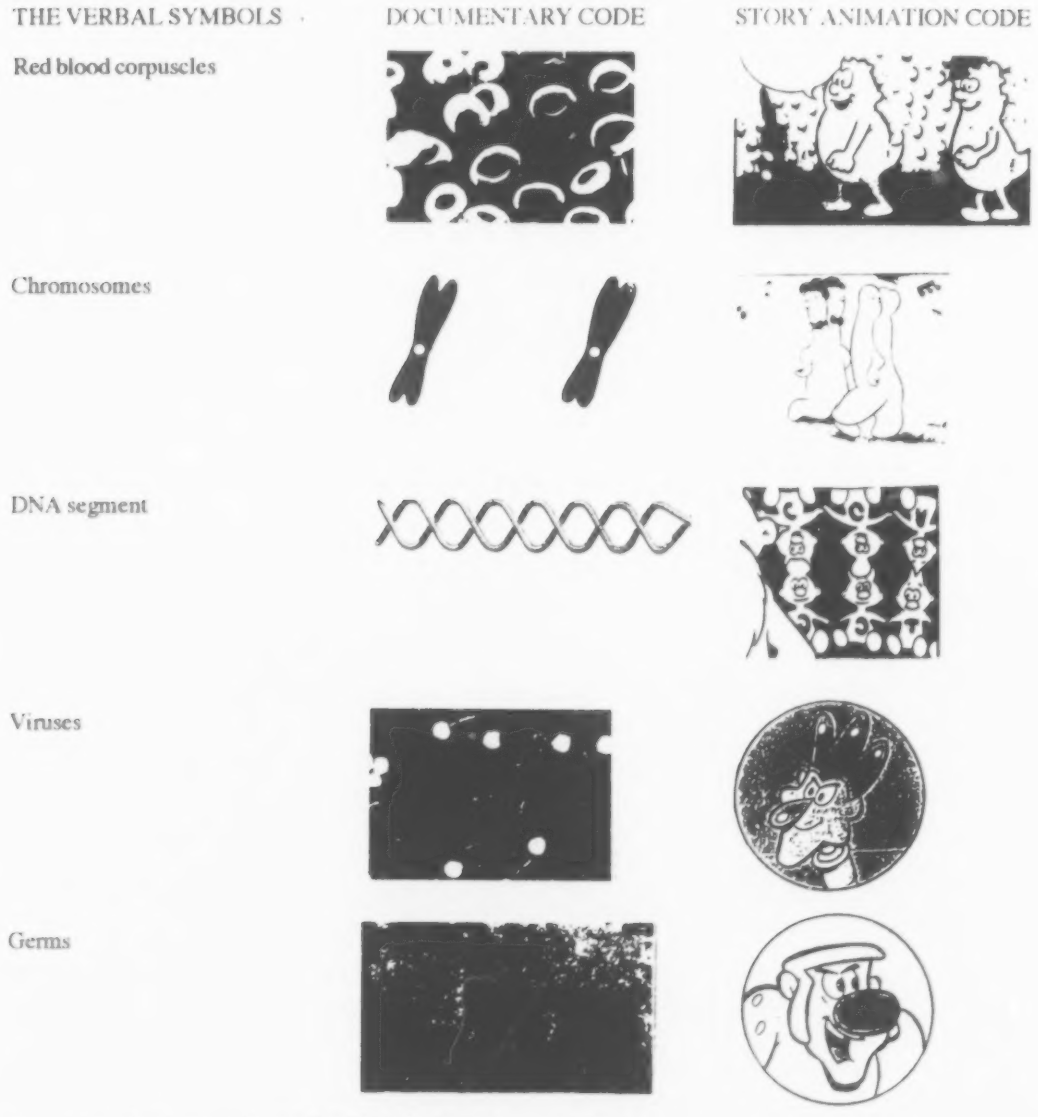
The Documentary Code is made up of scientific symbols--models, schematic drawings, and other drawings used in the teaching of science.

Figure 1 gives examples of a few biological concepts represented differently in the two codes. The verbal symbols in the table represent the scientific concept in words and the pictures represent the visual symbols.

Tables 1 and 2 show the distribution of concepts included in the broadcasts which were investigated in the research.

The questions dealing with cells, organells, and substances are used to test

Figure 1. Examples of Visual Representations of a few Biological Concepts Examined in the Research.



concepts, the perception of which is based on the schemata, categories, and images of these subjects. The questions that deal with the understanding of processes test a higher cognitive level based on a concept set that is basically visual. For example, images of DNA and chromosome structure help to understand the genetic code.

This paper focuses on learning of biological concepts. Table 2 presents the tests used for evaluation and their range of scores.

Gain was calculated by post test minus pretest scores. Comparison between the groups was done by F tests and T tests in dependent samples and independent samples. The influence of independent variables was estimated and expressed by effect size. Frequency distributions were calculated for background and attitudes.

Table 1. The Biological Concepts as Represented by Items in the Knowledge Test

SUBJECTS	CONCEPTS	TESTS & ITEMS TEST 1	TEST 2	TEST 3
SUBJECT THE CELL				
Processes & concepts	Nutrition, digestion	1	6	
	The living cell	2,4	4	1,9
	Genetic code	7,8	11,12	8
	Cell proportions	10	3	
	Breathing	8		
Substances	Oxygen	10		3,7
	Enzyme	9		1,4
	Protein	3	2,9,10	
	Sugar			10
	Fat			10
Cells	Red blood corpuscles			3
	White blood corpuscles			5
Organells	Chromosomes			8
	Cell nucleus	5		7
	Mitocondria	15		4
	Cell membrane		6	
Difficult concepts	Energy	1,5,7,8		
		1,6		
	Permeability	3,13,1,4		
SUBJECT BIRTH				
Processes & concepts	The living cell	2,4	4	
	Cell division	4		
	Genetic code	7,8	11,12	5,7,9
	DNA duplication			8,11,12
	Cell mitosis			6,11
	Pregnancy			5
	Sex determination			9
	Birth	4,8		10
	Cells, tissues, organs	2	4	13
	Cell proportions	10	3	
Cells	Ovum			3
	Fertilized ovum			4
	Sperm cell			3
	Red blood corpuscles		3,5,7	
Organells	Chromosomes		8	4,6
Substances	Proteins	2	2,9,10	
	DNA	8		
	Enzymes	1		
	Oxygen	10		

Data Analysis

Table 2. Tests Used for Knowledge Gain Measurement

Test No.	Abbreviated Name	Type of Test	No. of Items	Evaluation of Open Questions	Maximum Score
1	STK	Open questions	10	According to 6 categories	50
2	MCT	Individual report	16	5 categories	80
3	ATQ--cell	Multiple choice	9	correct answers	9
4	ATQ--birth	Multiple choice	13	correct answers	13

Titles of the Tests--Key to Abbreviations

STK	State of Knowledge Test
MCT	Misconception Test
ATQ	Anthropomorphic Teleologic Questionnaire
ATQ-cell	ATQ subject: The Cell
ATQ-birth	ATQ subject: Birth

Summary of Research Findings

This summary covers the findings of both qualitative and statistical analysis that were carried out. The results present a promising picture of the educational potential of television in out of school situations.

1. Viewing television broadcasts presenting biological concepts resulted in a significant improvement in the knowledge.

2. Gain was found in both codes examined, namely the documentary code and the story animation code.

3. The students/subjects were equally sympathetic to the two codes examined.

4. The two student groups differed in knowledge gain and attitudes; among the technological students there was greater knowledge gain and even more positive attitudes towards the story animation code.

5. Gain was accompanied by misconceptions. There was a relative decrease in causal explanations in favor of anthropomorphism and teleology following the screening of the story animation in the topic of the living cell. No such effect occurred in the subject *Birth*. On the other hand, regarding the subject *Birth*, an increase was registered in the number of causal statements following the screening of the story animation code.

Discussion

The process of visual cognition may be seen as a set of stages in information processing: visual object or symbol -> visual stimulus -> attention -> perception -> image -> memory -> visual thinking -> solution (formation of the concept) -> reaction. Preceding the solution stage, other cognitive processes from verbal sources merge and only then the reaction begins. Attention depends on motivation which is based on prior knowledge and personal factors, as well as factors arousing interest and curiosity that are embedded in the stimulus such as the novelty of the stimulus or an inconsistency between the stimulus and its context.

The results of our study, namely the exhibiting of knowledge gain following the viewing of the story animation code, support the perception approach of Gombrich (1972) and Gregory (1978) which claims that perception of the visual field does not depend merely on sight-related factors. In certain respects we see what we believe. Our research results substantiate Gombrich's claim of the non-existence of an *innocent eye*. Even when no visual similarity exists between the pictorial representation and reality, a series

of inferences can still be drawn from the picture by using the information it contains about itself.

The notion in our study of pictorial representation regarding the biological terminology goes beyond sight itself and must be attributed to the viewer's prior conceptual knowledge. Furthermore, the findings of this study affirm McLuhan's (1964) claim that the television image leaves room for *filling-in* by the viewer. Any television image is unprocessed and unrefined, like that in comic books (McLuhan, 1964). Since the broadcasting of the story animation is a kind of televised code of comics, the viewer needs to do a double fill-in utilizing his prior knowledge.

This means that the story animation code portrays biological concepts using symbols, and it appears that viewers perceive the visual message employing schemata and images that exist in their memory. Identification of the animated shapes using the conceptual system is a process of translation of the coded television message. The term decoding (rather than the more novel *translating*) bests describes this process of identification which is carried out, according to Blich (1989), by way of:

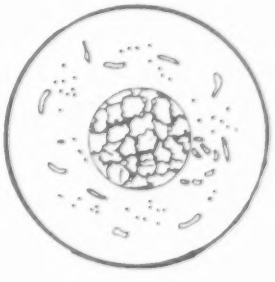
1. Projection of the viewer's prior knowledge on the visual message.

2. Filling-in of the picture being viewed using prior knowledge and preconception.

Schemata and pre-existent images are employed in the decoding process for the identification of visual symbols.

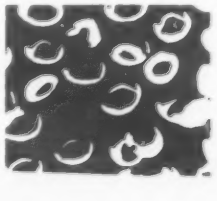
The notion of scientific symbols as visual symbols was examined for the first time ever in this study. Two codes were examined: The documentary code in which biological concepts are presented as *scientific symbols*, and the story animation code in which the same concepts are presented and portrayed as *artistic symbols*. The questions proposed in this study examined knowledge gain and attitudes derived from the imagery potential of the subject. The focus was on scientific symbols and the creation of their *scientific images*. Schemata and images based on conventional scientific symbols are used in deciphering. According to Howard (1987), schemata serve as a filter and only part of the information is passed through them. Consider, for example, a student who knows that the living cell is the smallest living unit of structure and activity that exists. His schema of the single cell appears to be like this:

Schema of a Cell



The students see in the story animation broadcast what they *believe*, or rather *know* about the cell, and rely on the image of the already existing concept. The animation code, it should be recalled, contains symbols that arouse curiosity, are stimulating and motivating, and encourage positive attitudes. The information presented in the broadcast is filtered and accumulates in the viewer's mind, and there is educational value in bringing the concept to the center of cognitive activity. This activity is important in securing and enriching the memory of the conceptual system of the visual images. A person viewing the story-animation code is forced to draw a comparison between the *conceptual image* for the given concept that exists in his memory and the symbols in the broadcast. This comparative examination appears helpful in internalization of concepts. For example:

Red Blood Corpuscles



Globin, Hemo, & Globus

As the viewer of the documentary code adds to the treasury of *visual symbols* related to this conceptual system of the subject being viewed, his science imaging ability improves. While an individual who uses exclusively verbal channels of reading and hearing learns only certain facts about the circulatory system; someone who, on the other hand, views the same thing in a documentary broadcast hears the terms verbally and sees the scientific symbols. The viewer of the documentary code is provided with images for the red and white blood corpuscles, the heart, and the blood vessels. The symbols projected on the screen will be recalled as schemata or images and comprise the visual basis for the viewer's conceptual system of this subject. The theoretical foundations of these references are found in the fields of the psychology of learning and semiotics. Nevertheless, they warrant further research with the intention of focusing on the scientific concept, how it is received by the senses, and how it is stored in the memory.

Recommendations

Given that we live in the era of communication media, it is imperative that we give more thought to how technology influences learning. The results of this study support the conclusion that concepts in the sciences may be learned by means of unguided television viewing. The recommendations of this study are intended for policy makers in television broadcasting stations, writers, and producers of programs for the sciences and people involved in supervision, instruction, and research in the teaching of the sciences.

Broadcasting Policy and Production of Science Related Subjects

The screening of a large and varied number of television broadcasts in the sciences will encourage and intensify the acquisition of knowledge. Accordingly, the more television time alotted to the screening of broadcasts in the sciences, especially popular programs that incorporate scientific concepts, the more positive will be the attitudes of the viewers regarding the sciences, and the greater will be the knowledge gain about televised concepts among the viewing public.

Considering the immense popularity of the animated story code, it is highly recommended to continue producing television series in this code. However, consideration should be given to the correct interpretation of the symbol system of the medium of television.

Improving Production of Broadcasts in Sciences

Misconceptions, says Howard (1987), are the unavoidable results of the learning process. This was confirmed by our research into the two codes. In order to minimize, as much as possible, the formation of misconceptions resulting from the television viewing of broadcasts in biology and the sciences, special attention should be given to sensible production of these broadcasts. Since this medium is auto-didactic, the television screen itself can be used to guide the viewer in the direction of the desired outcome. It would be most advisable to implant in the broadcast itself an exact explanation of the concepts to be taught in both picture and sound. By incorporating such an explanation into the beginning of a broadcast, the explanation becomes the basis for continued viewing of the broadcast. Good broadcasts in the sciences targeted for viewing by children and teenagers do exist today, and they employ a mixture of several genres, in which discrete concepts are explained in a number of codes. The result is that

documentary film, acting, and animation merge and interact in the same broadcast.

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